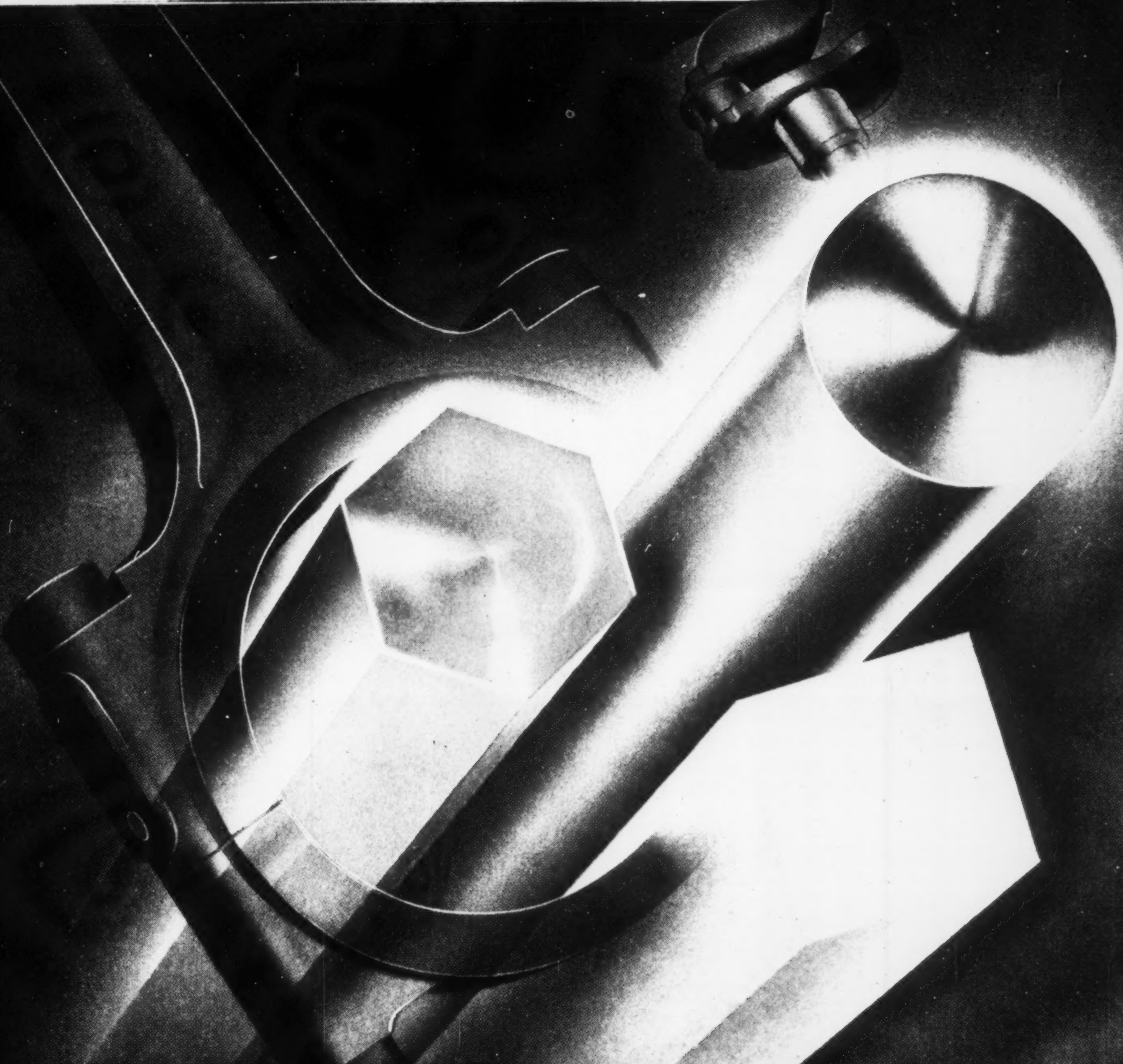
MACHINE DESIGN

October 1947



MATERIALS DIRECTORY ISSUE

C-H 9586
The Standard motor starter that is Specially Engineered throughout
START
STOP RESET
CUTLER-HAMMER
MOTOR CONTROL
C-H
START
STOP RESET

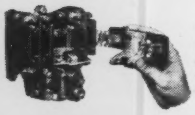
You get *PLUS* features . . . when you specify Cutler-Hammer *Standard* 9586 Motor Control for your squirrel cage motors.

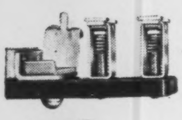
This is not a starter made up just to sell in a package and at a price. It is a starter embodying what Cutler-Hammer Engineers have learned in more than a half century of solving *all* motor control problems . . . special and standard alike.

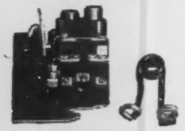
No other starter gives you the exact and accurate protection which you find in the 9586 overload relay . . . the famous Eutectic Alloy overload relay that enables you to drive every motor to its safe limit . . . *saving* power, *saving* time, *saving* money. No other starter offers the Cutler-Hammer specially designed and processed vacuum-impregnated coil construction that virtually eliminates all coil troubles in small motor control performance.

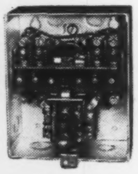
The same *special engineering* approach is found in the STANDARD C-H 9586 contacts, in the arc shields, the contact structure . . . in every other detail. This same *special engineering* quality applied to a STANDARD package item is moving more and more shrewd control buyers to *insist* on the 9586 starter and accept no other . . . for maximum life, and dependability, and minimum attention. CUTLER-HAMMER, Inc., 1310 St. Paul Ave., Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

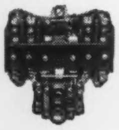
Only in C-H *STANDARD* Control
Special Engineering Features Like These


Vertical Dust-Safe Contacts, cool, accessible, safe . . . mean better control.

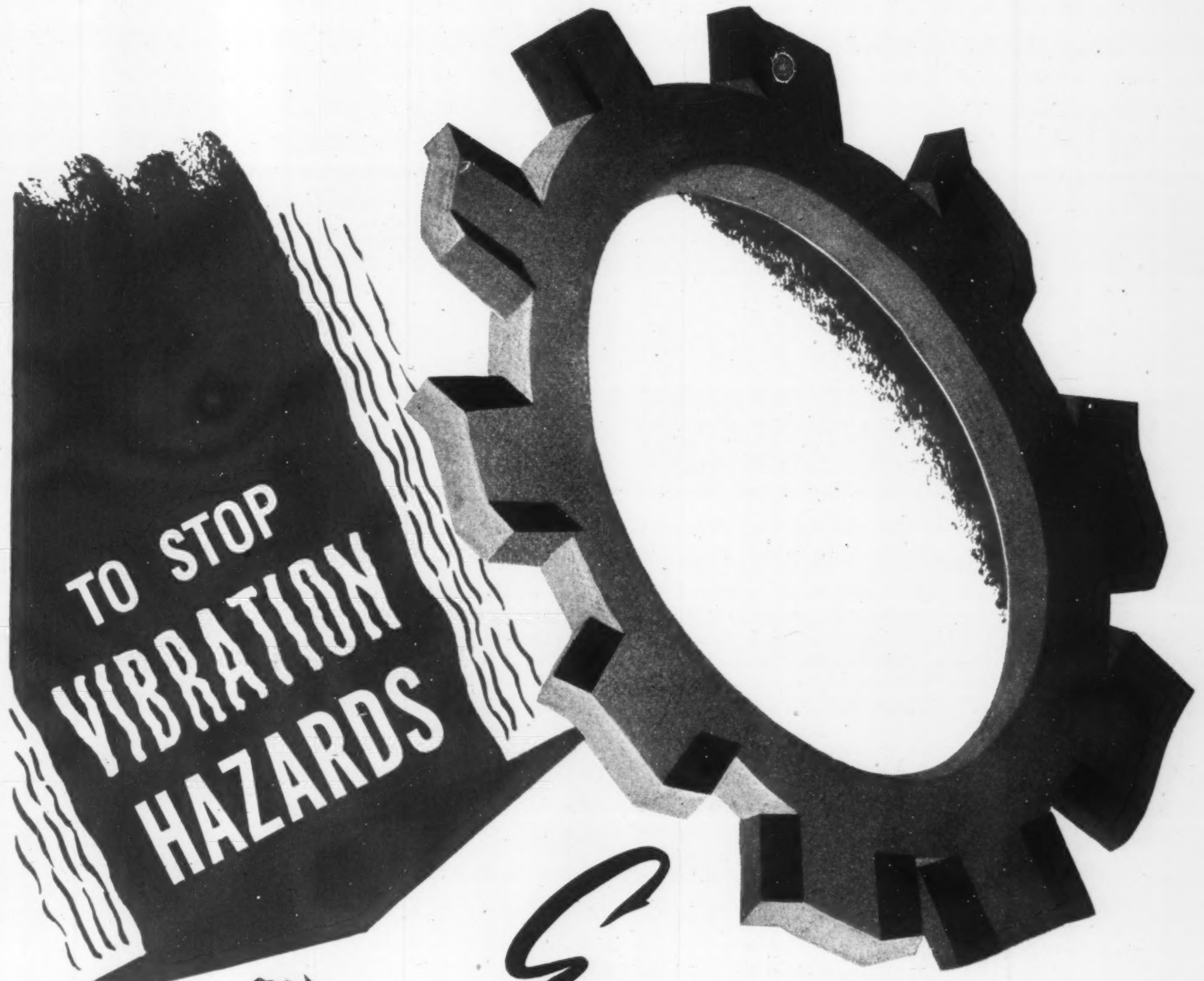

Heavy pure silver contacts. Lava insulators keep heat from stainless steel contact springs, insuring contact pressure.

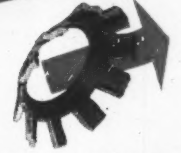

Famed "Drop of Solder" overload relay further refined, free-tripping. New heater coil construction.


Densheath internal wiring for fine appearance. Advanced design, modern cover, light interior. Case has solid back. Mechanism rubber mounted.


Starter available with or without push-buttons in case, with transfer switch, in combination starter, as "skeleton."

CUTLER-HAMMER
MOTOR CONTROL
C-H

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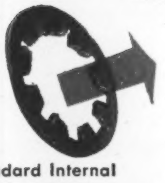
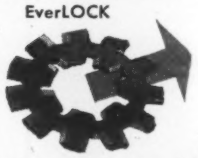
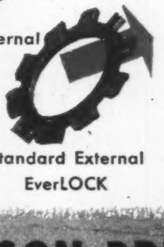

Standard Internal
EverLOCK


Standard Internal-External
EverLOCK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MACHINE DESIGN
October 1947

This Month's Cover: Choice of materials at the designer's command when specifying for component parts of machines is symbolized by artist Roland Veit for this Materials Directory Issue.

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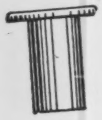
Rivnuts solve tough problem in NEW BUILDING DESIGN

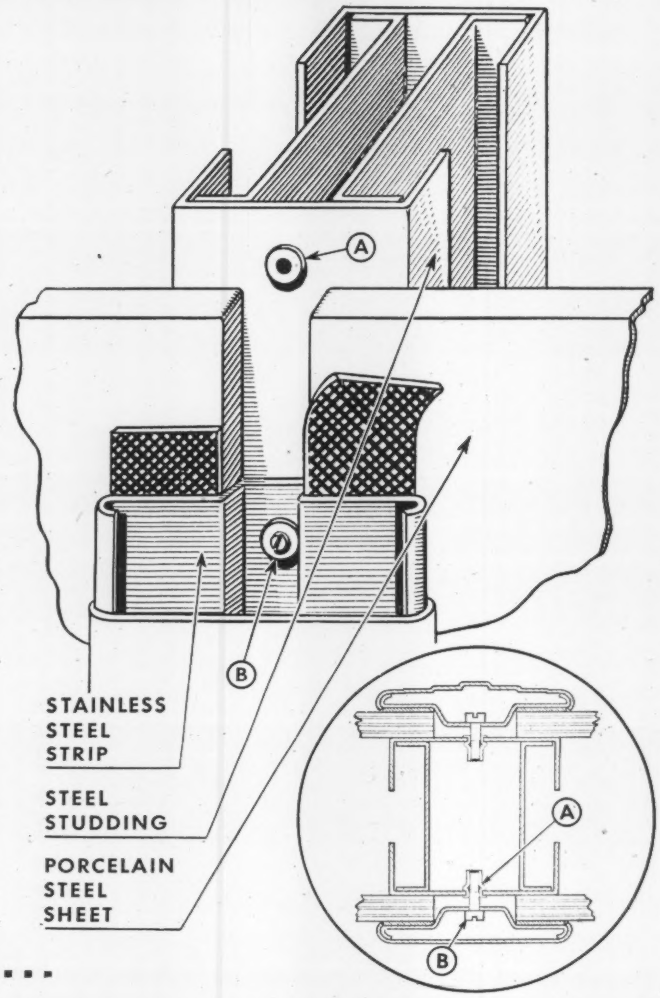

FLAT HEAD RIVNUT

Architects for a "quick-lunch" restaurant chain had an exceptionally tough problem in designing their new pre-fabricated building. Walls of porcelain steel had to be attached to the steel upright studding in such a way that they could be easily torn down and moved. Good sealing was a must. Because B. F. Goodrich Rivnuts serve as both blind rivets and nut plates, they provided the ideal solution.

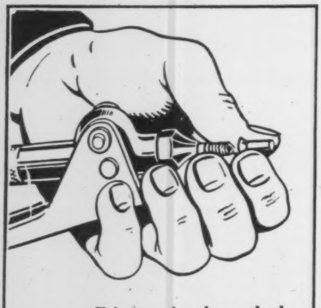
Rivnut "A" is inserted in the studding and upset. Its flat head and the firm bulge formed in its shank grip the studding tightly. The still-intact Rivnut threads furnish a deep nut plate for attaching the walls.

When threaded into the Rivnut, cap screw "B" securely fastens the steel strip (which holds the porcelain sheets and asphalt sealing) to the studding. A trim strip is snapped into place to complete the outside assembly. Interior panels are similarly attached.

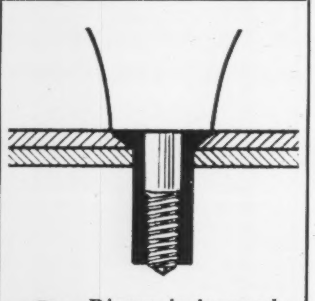
Because these walls can be removed quickly and easily for either moving or repair, Rivnuts mean big dividends in time and money saved. If *you* have a fastening problem, why not consult a Rivnut engineer? Write to The B. F. Goodrich Company, Dept. MD-107, Akron, Ohio.



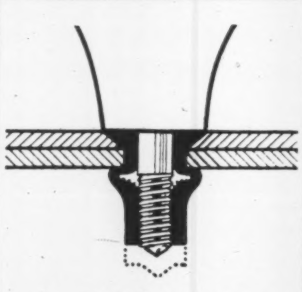
. . . installation is simple and quick . . .



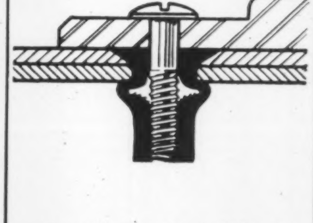
1. Rivnut is threaded onto pull-up stud of a manual or pneumatic heading tool.



2. Rivnut is inserted —with head firmly against, and at right angles to, work.



3. Tool lever operates to retract pull-up stud, forming a bulge in the Rivnut shank.



4. After upset, Rivnut threads are still clean and intact, ready for screw attachment.

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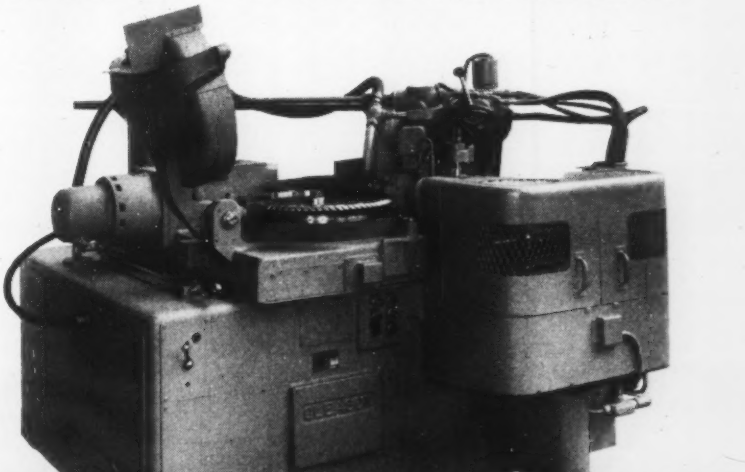

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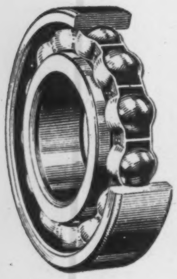

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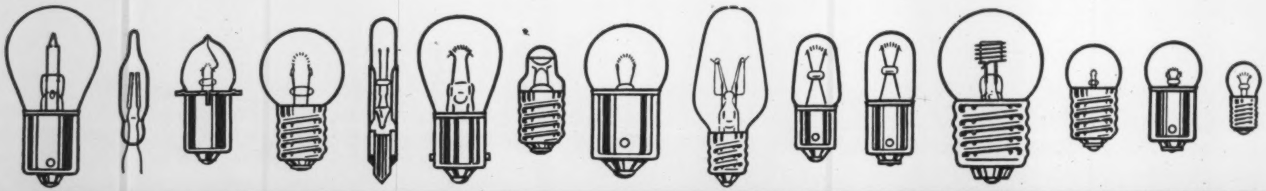

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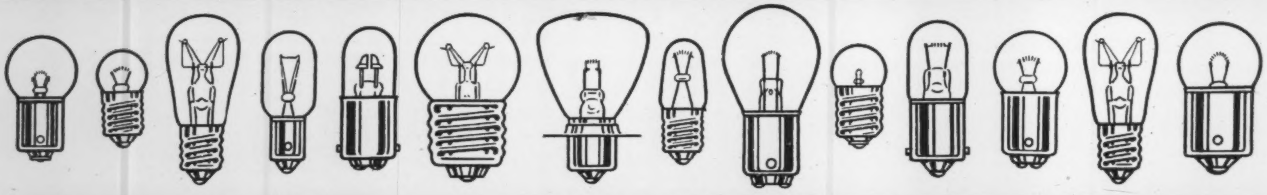

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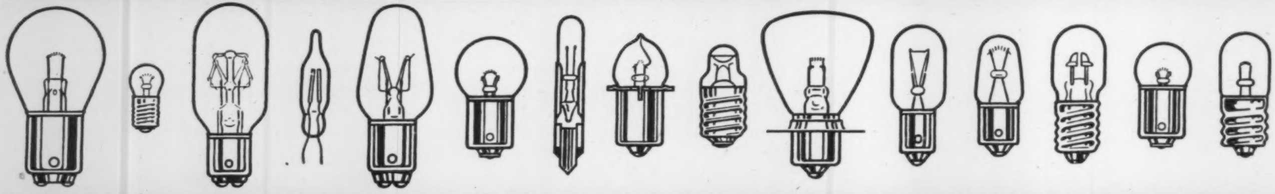

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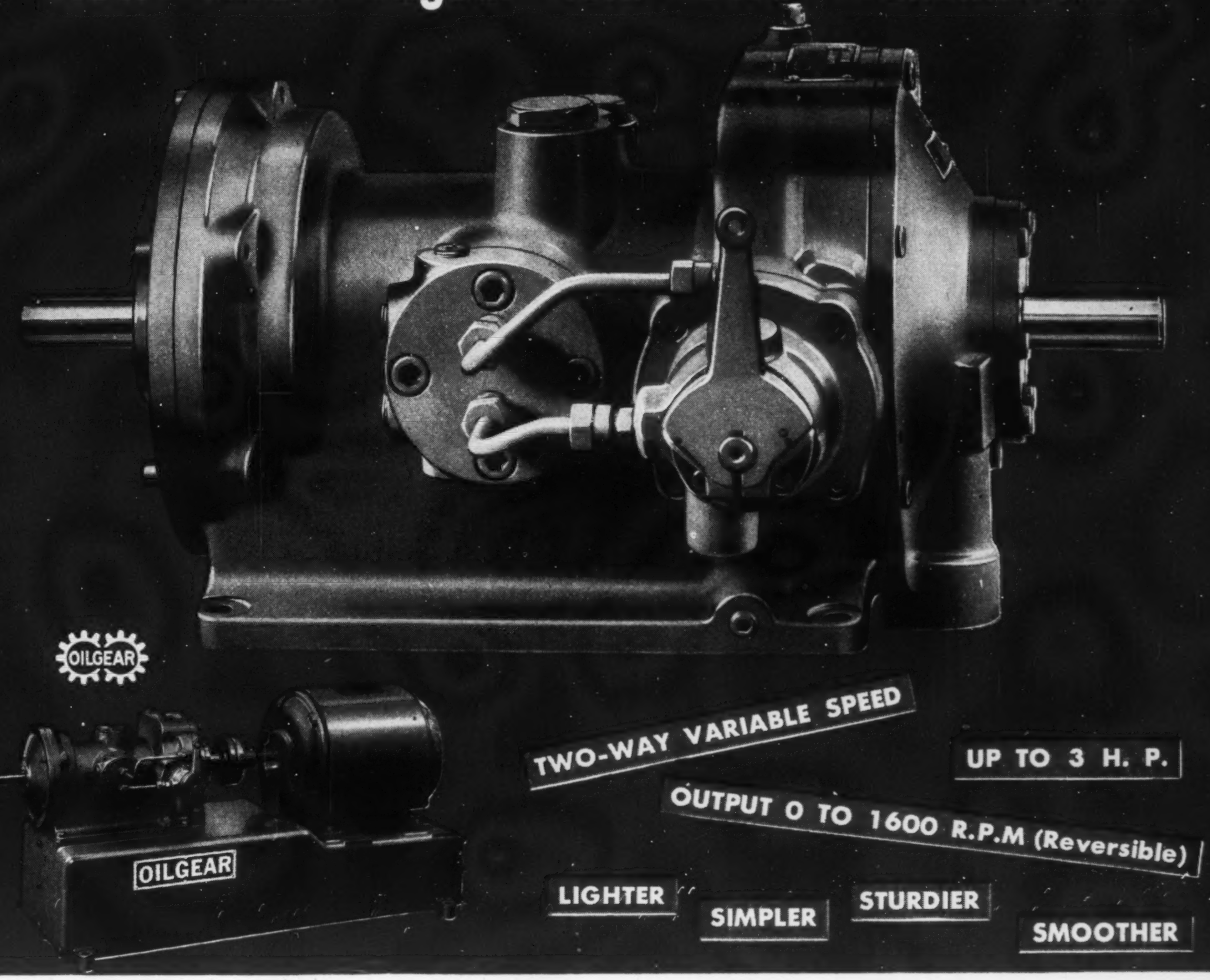

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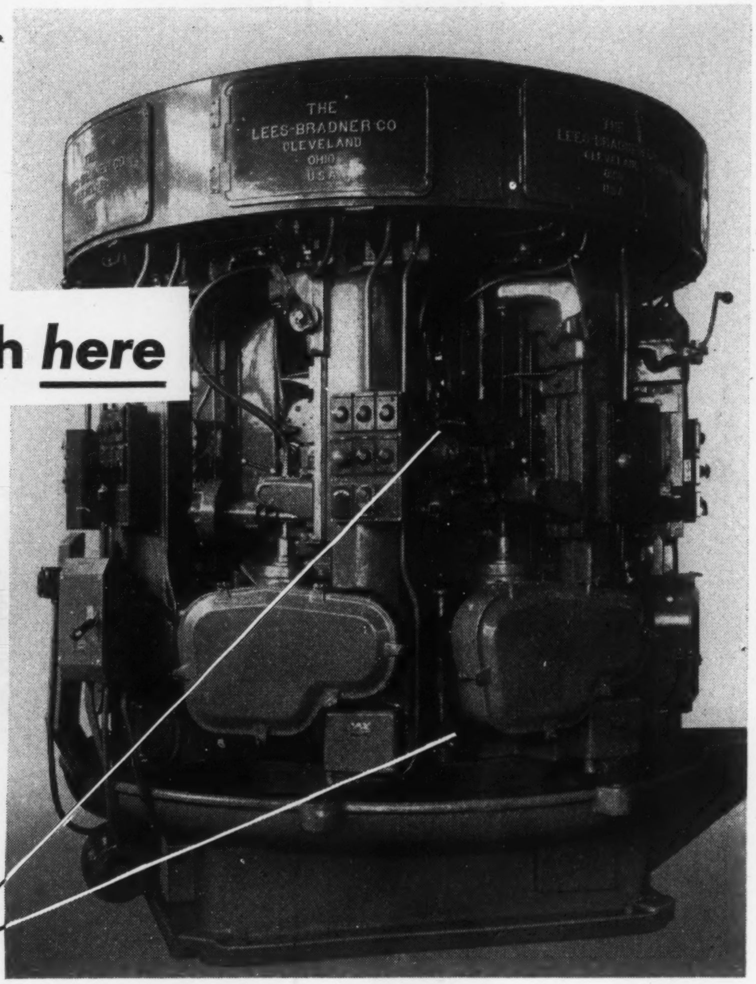
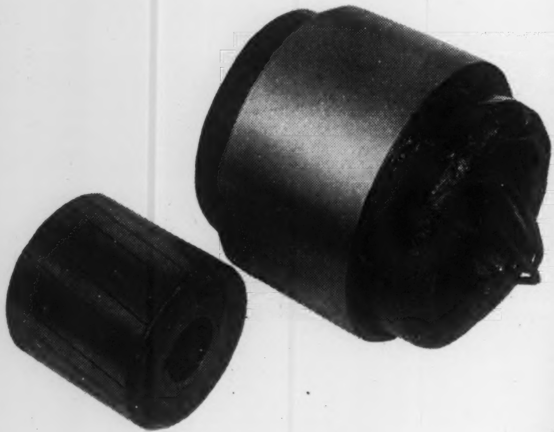




BUILT-IN OHIO MOTORS are an integral part of machine's frame at each hobbing station. Ohio Shell Type Motors ratings range from ¼ to 7½ H. P. Speeds from 800 to 3500 R. P. M.—for 2 or 3 phase service.

ohio
MOTORS

Every inch of space counts when you design an eight spindle rotary hobbing machine that combines push-button control with precision production.

Builder of this specialized gear hobbing machine for the automotive industry is The Lees-Bradner Company. This concern recognized space and cost saving advantages of built-in shell type motors more than 15 years ago . . . urged their development.

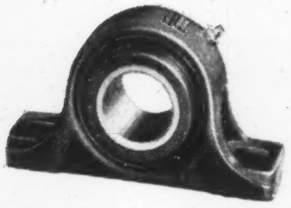
Today, Lees-Bradner's amazingly compact new eight spindle rotary hobbing machine covers a floor area *of only 97 square feet.*

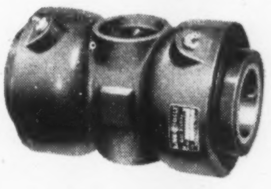
Smaller diameters of *16 standard Ohio Shell Type Motors* help to conserve space. At each of eight hobbing stations there are two Ohio Motors. One, rated at 2 H. P., raises and lowers the carriage. A second ¾ H. P. Ohio Motor feeds the hob into and out of the work.

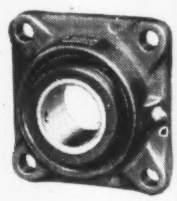
This application of Ohio Motors is typical of the way leading manufacturers have solved difficult design problems with *standard* Ohio Motors *for more than 25 years.* Write today for data on the *reliable* Ohio line.

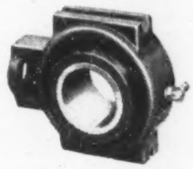
THE OHIO ELECTRIC MFG. CO. 5906 MAURICE AVENUE • CLEVELAND 4, OHIO

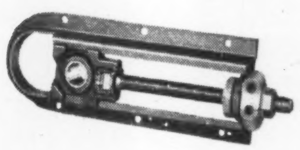
A full line of bearings calls for a full range of mountings—the Link-Belt line of ball and roller bearings offers just this—to meet all conditions of service efficiently. Some of the Link-Belt ball bearing mounted units are shown below:

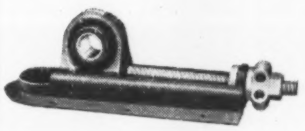


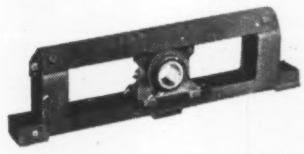


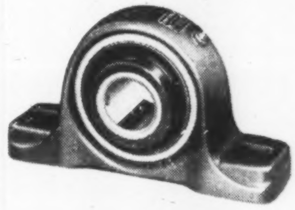


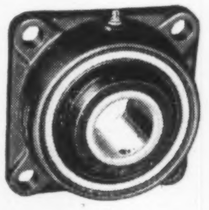


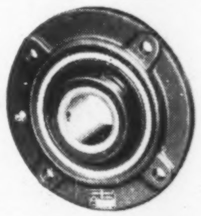


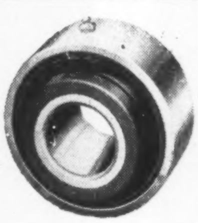


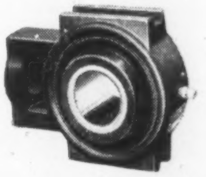












1 P-200 Pillow Blocks are compact, easy to mount and adjust. Open or closed end. Base affords space to drill for dowel pins.

2 H-200 Hanger Unit mounts two single row ball bearings in dumb-bell housing. Fits standard hanger frames.

3 F-200 Flange Units. Open or closed end, with machined face, and space for doweling to supporting structure. Can be used as step bearings on vertical shafts.

4 T-200 Ball Bearing Take-Up Unit permits varying shaft position to adjust belt, chain, etc. Furnished without frame guides or adjusting screw.

5 TAS-200 Light duty take-up. Pressed steel frames and cadmium plated adjusting screw.

6 TBS-200 Cast base take-up, with ball bearings correctly proportioned for each shaft size, occupy minimum space.

7 TDS-200 Take-up recommended where severe shock loads are expected. Center bar furnished on 24" movement and over.

8 P-300 (Fixed Type) and PE-300 (Floating Type) Pillow blocks. Compact, slotted bolt holes, space for drilling base for locating dowel pins.

9 F-300 (Fixed Type) and FE-300 (Floating Type) Flange Units, can be used as step bearings for vertical shafts.

10 FC-300 and FCE-300 Flange Cartridge Units provide simple mountings for use in cast or welded frames.

11 C-300 and CE-300 Cartridge Units are ideal for machine frames. Shaft may be removed from machine without disturbing bearing assembly.

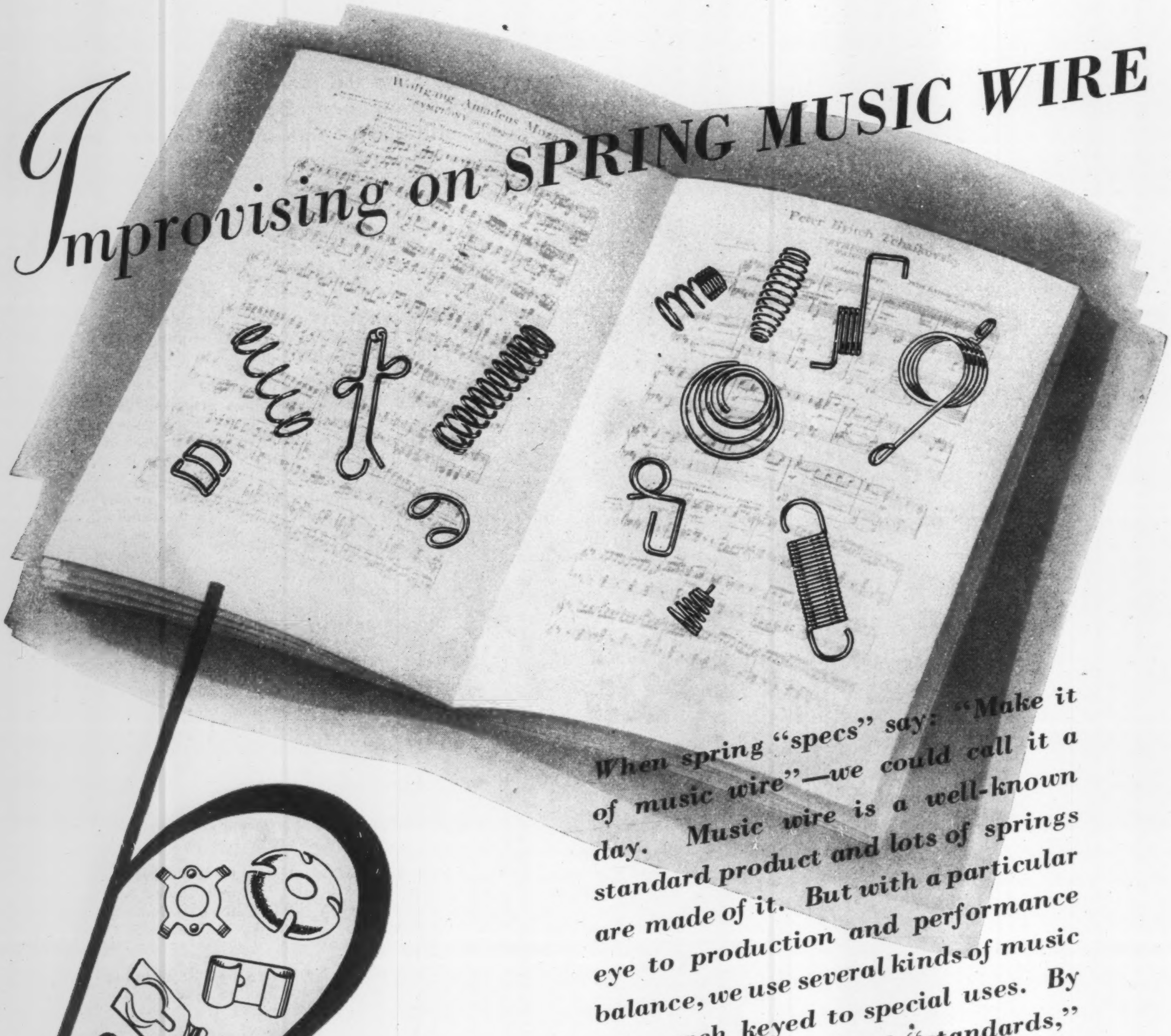
12 T-300 Ball Bearing Take-up Unit allows shaft movement to adjust belts, chains, etc.

LINK-BELT

BALL AND ROLLER BEARINGS

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 2, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities. 10.358

Improvising on SPRING MUSIC WIRE



When spring "specs" say: "Make it of music wire"—we could call it a day. Music wire is a well-known standard product and lots of springs are made of it. But with a particular eye to production and performance balance, we use several kinds of music wire, each keyed to special uses. By broadening the field of "standards," Wallace Barnes provides additional possibilities for quality control and economy in springmaking.

Sharp with the "Flats," too!

For flat springs and small stamped parts, Wallace Barnes also processes in its own mill many tempers and hardnesses of spring steel to meet requirements of intricacy or endurance.

Wallace Barnes SPRINGS

SMALL STAMPINGS • WIRE FORMS • HAIRSPRINGS • COLD ROLLED SPRING STEEL

WALLACE BARNES COMPANY
BRISTOL, CONN.

DIVISION OF THE ASSOCIATED SPRING CORP.

AND IN CANADA, THE WALLACE BARNES CO., LTD., HAMILTON, ONTARIO

FRACTIONAL HORSEPOWER GEARING
GS
CENTERLINE OF GEAR
3/8
.3749
.3744
.690
CASE … .015" - .020"
1400°/1450° F.
TO 77 ROCKWELL 30 N SCALE
REMOVE ALL BURRS AND SHARP CORNERS EXCEPT WHERE OTHERWISE SPECIFIED. LIMITS ARE
ON ALL DECIMAL DIMENSIONS AND
ON ALL FRACTIONAL DIMENSIONS.
-1118 STEEL
AR SPECIALTIES
DRIVE

YOU CAN BUY THE SKILL THAT MADE THESE GEARS

The same skill with which we fabricate Small Gears for so many of America's most particular users, is also available for *you*. Get started now depending upon this one BIG source for all of the Small Gears you need. Here, you'll enjoy the advantage of all the large, highly specialized facilities developed thru a quarter century of concentrating on the manufacture of finer Small Gears exclusively.

If you need production runs of Fractional Horsepower Gears that perform more smoothly and accurately, that measure up to highest *uniform* standards of quality and precision, by all means discuss your requirements with a G.S. Engineer! Possibly he may suggest a better design, a more practical material, a method of production that will result in better gears, at moderate cost. Will you write or telephone us *today*?

SEND FOR OUR CATALOG BULLETIN

IF IT'S A SMALL GEAR PROBLEM
Ask GS
GEAR Specialties

GEAR Specialties

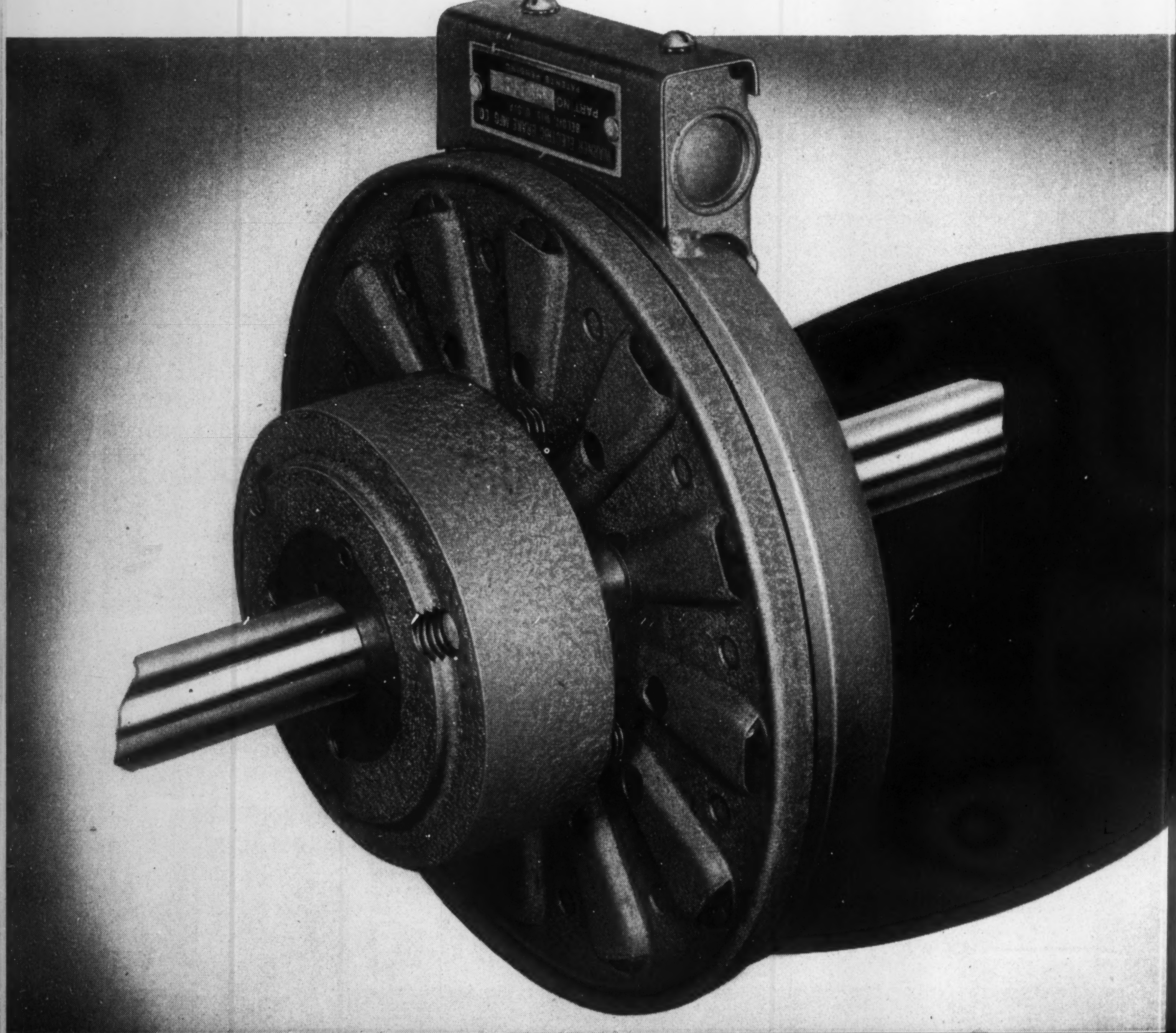
Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

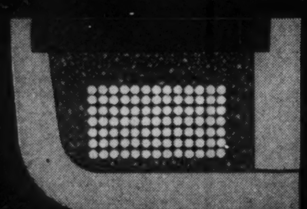
2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

MEMBER OF AGMA

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

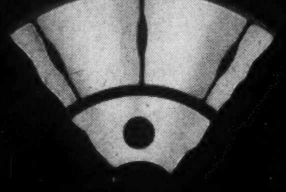
IT'S A CLUTCH - IT'S A BRAKE





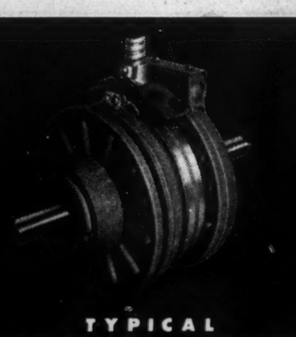
MAGNET SECTION

Consists of a unique electro-magnet design faced with a selected molded friction material. Power is applied through coil shown solidly embedded below friction facing.



ARMATURE SECTION

Wear surface made up of segments of magnetic material welded to steel back plate. Expansion of segments, caused by heat of clutch or brake action is linear, keeping armature in full contact with magnet. Heat has little effect on operation.



TYPICAL ICB INSTALLATION

This typical installation shows simplicity and compactness of clutch-brake unit, ease and flexibility of assembly to machinery.

IT'S THE *New* WARNER "ICB UNIT*"

THIS STARTLING DEVELOPMENT offers you advantages never before incorporated in an electric brake or clutch unit

❶ **OPERATES INSTANTLY** – Lightning fast action! . . . it operates electrically. No gaps to close or slack to take up. No hinges, adjustable springs, lever actions, cams or solenoids to cause a "lag". Action starts when current is applied.

❷ **NEW SUPER STARTING OR STOPPING POWER** – The secret of this new power is the fact that it utilizes not only ordinary friction, but in addition uses the power of electromagnetic attraction between its ring-shaped electro-magnet and armature disc.

❸ **INFINITE CONTROL** – Because the applied power varies with the flow of current through the magnet, the Warner ICB Unit offers a range of applications heretofore unknown. Clutch or brake action may be controlled to a fine degree, manually or automatically, as machine operating cycles require. Rectified power is supplied from 110, 220 or 440 volt A.C. source or 6-12 volt battery.

❹ **CONSTANT SELF-ADJUSTMENT** – The armature disc rides in constant light contact with the friction surface of the electro-magnet. Where application requires, light spring pressure maintains this constant contact and follows up all wear between the two surfaces, thus eliminating the need for any mechanical attention.

❺ **REQUIRES MINIMUM INSTALLATION SPACE** – The space required is such that it can be readily worked into the design of machinery. Four sizes are at present available: 8½, 10¼, 12½ and 15½ inches in diameter. The shaft length occupied by the armature and magnet unit of any of these sizes is less than 2½ inches.

❻ **LOW COST** – The Warner ICB Unit has fewer parts for the same clutch or brake action than any other clutch or brake unit. This is reflected in cost. When the magnet and armature become worn after prolonged service, they are easily replaced at nominal cost. There are no lists of spare parts for the user to stock.

❼ **UNMATCHED HEAT DISSIPATION** – The steel back plate of the armature disc is designed to act as a blower. This blower action dissipates the heat where and when it is generated.

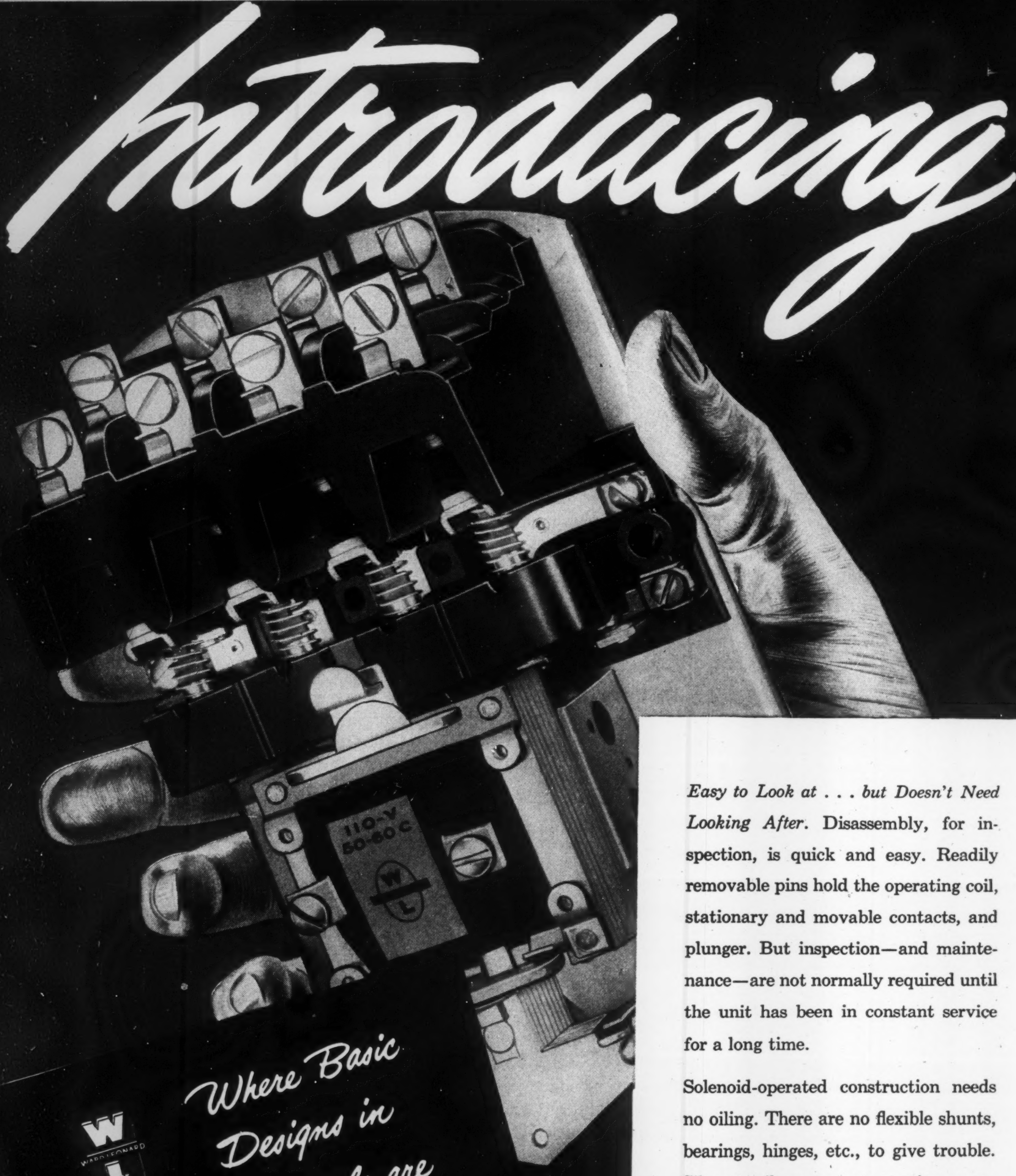
❽ **INFORMATION AND ENGINEERING SERVICE** – Warner Electric Brake Units have been successfully used for twenty years. The experience of these years of brake manufacture and application are yours for the asking. For detailed information on the Warner ICB Unit as a clutch or brake for machinery applications write the Industrial Engineering Division.

* ICB Unit—The trade designation for INDUSTRIAL CLUTCH OR BRAKE UNIT.

WARNER
ELECTRIC BRAKE MFG. CO.
BELOIT, WISCONSIN

Makers of Electric Brake Units since 1927

WARNER
ICB UNIT


Introducing
110-V
50-60 C
W L
W L
WARD LEONARD
Where Basic
Designs in
Electric Controls are
__esult-__ngineered
for You

Easy to Look at . . . but Doesn't Need Looking After. Disassembly, for inspection, is quick and easy. Readily removable pins hold the operating coil, stationary and movable contacts, and plunger. But inspection—and maintenance—are not normally required until the unit has been in constant service for a long time.

Solenoid-operated construction needs no oiling. There are no flexible shunts, bearings, hinges, etc., to give trouble. Silver-to-silver contacts require no periodic filing, smoothing or other dressing. All coils are vacuum-impregnated.

WARD LEONARD

A NEW CONTACTOR

. . . first in a new series by

WARD LEONARD

Ward Leonard's new Size 1 Contactor is the first of a series of standard a-c solenoid contactors available for specialized controls.

In one compact structure are the minimum number of parts assembled on a steel mounting plate*. A cold-molded insulating arc hood holds the stationary contacts securely in place and confines the arc on breaking the load circuit.

An important feature is the silver-brazing of the silver contacts directly to line and load terminals, eliminating threaded or riveted joints. Main double break contacts and coil terminals are advantageously located to permit front-of-board connection.

*With NEMA Standard Mountings.

. . . It's Another Achievement of "Result-Engineering"—A lower assembly cost for *your* product . . . or its better performance . . . is the objective of Ward Leonard's "Result-Engineering" of electric controls. Basic designs adapted to your requirements give you the desired results at lower cost than a "special".

The simplicity of the design of the 4451 AC Contactor makes it adaptable to many applications. For further information write for Bulletin 4451. Please use business letterhead and mention your title.

Blue means "Result-Engineering"—In resistors, rheostats, relays and other electric controls, the distinctive blue identifies Ward Leonard "Result-Engineering".

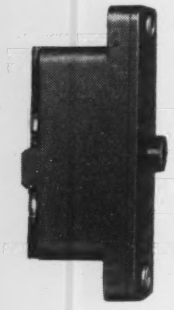
WARD LEONARD ELECTRIC CO. Mount Vernon, New York • *Offices in principal cities of U. S. and Canada*

ELECTRIC CO. RESISTORS • RHEOSTATS RELAYS • CONTROL DEVICES

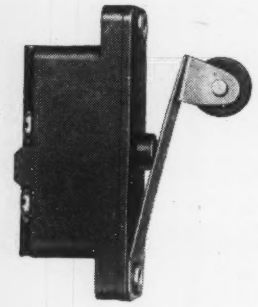
Square D offers a Complete

PART OF THE PARADE OF NEW DESIGNS

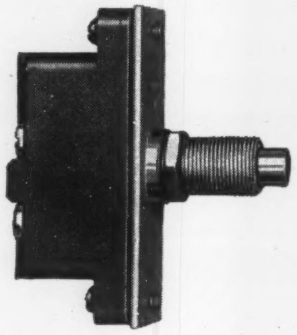
NEW OPERATORS for Square D's Popular Precision Contact Mechanism extend use to built-in machinery applications



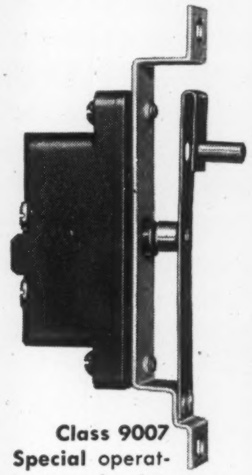
Class 9007 Type AO standard contact mechanism available in several contact and terminal arrangements.



Class 9007 Type AB roller-operated mechanism provides additional over-travel and eliminates side thrust on operating button.



Class 9007 Type AP plunger-operated mechanism has ¾" threaded ferrule for panel mounting, and ⅛" additional over-travel.



Class 9007 Special operating mechanism for door switch use—typical of the many special mechanisms that can be designed for a wide variety of built-in applications.

SELF-CONTAINED MECHANISM for making or breaking circuit—in small space—with short movement and light pressure.

1 • Simple Operating Mechanism, consisting of only two alloy leaf springs, has no dead center position and gives exceptionally long life.

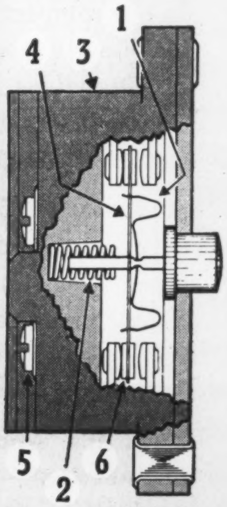
2 • Compression Return Spring of stainless steel insures positive operation and long life.

3 • Husky Melamine Case is not easily damaged through faulty installation or accidental impact, and is highly arc-resistant.

4 • Heavy Contact Blade is entirely separate from operating mechanism.

5 • Four Terminals have No. 6-32 binderhead screws suitable for No. 14 wire.

6 • Separate N.O. and N.C. Circuits have double-break, silver contacts. *(Ratings below)*



CONTACT RATINGS

	A.C. Voltage				D.C. Voltage		
Electric Ratings	110	220	440	550	115	230	550
Normal Amperes	15	10	6	5	2	0.5	0.1
Inrush Amperes	40	20	10	8	...	...	...

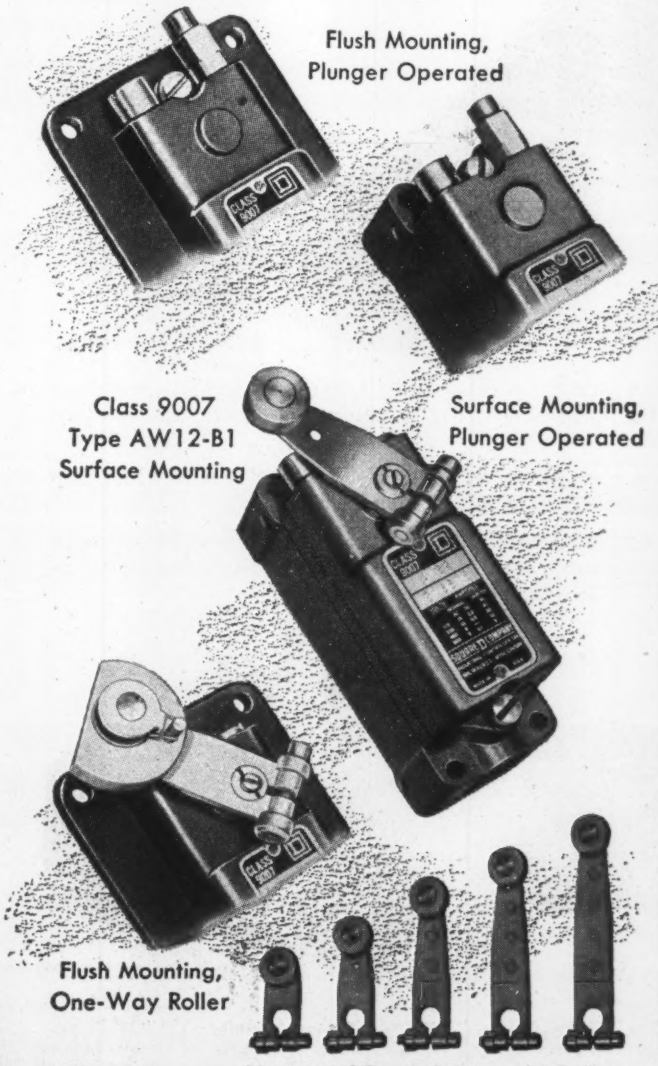
SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Line OF MACHINE TOOL LIMIT SWITCHES

SMALL SIZE with accurate operation, high electrical ratings and long mechanical life —Square D's Class 9007 Type AW precision contact mechanism, built into oil-tight enclosures. Available for either surface or flush mounting, roller or plunger operation and with a variety of standard and special operating arms.



Flush Mounting, Plunger Operated

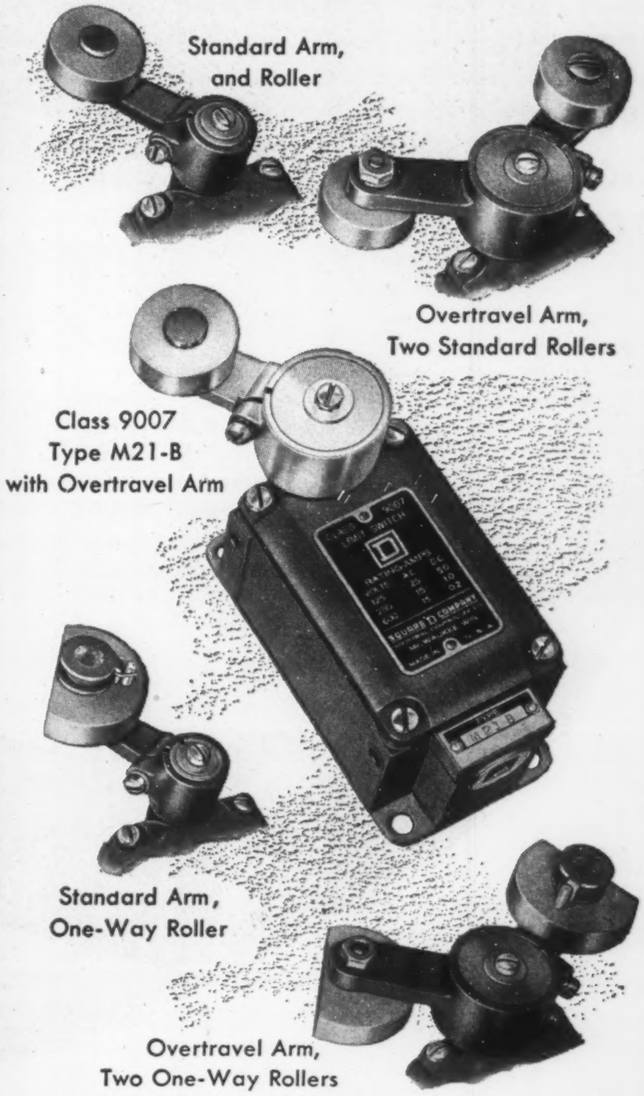
Surface Mounting, Plunger Operated

Class 9007 Type AW12-B1 Surface Mounting

Flush Mounting, One-Way Roller

Variety of Special Arms and Rollers

HEAVY DUTY for applications where space is not a factor and where service is unusually severe —Square D's Class 9007 Type M contact mechanism in surface mounting, oil-tight enclosures. Threaded conduit hub or back plate opening. Wide range of operating arms including standard and extra over-travel construction, as well as many types of rollers.



Standard Arm, and Roller

Overtravel Arm, Two Standard Rollers

Class 9007 Type M21-B with Overtravel Arm

Standard Arm, One-Way Roller

Overtravel Arm, Two One-Way Rollers

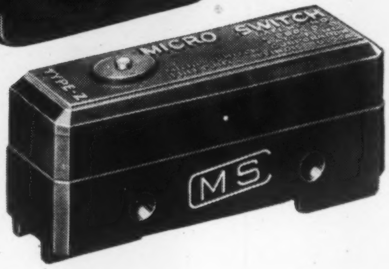
***Write* for descriptive bulletin 9007**

SQUARE D COMPANY, 4041 North Richards Street, Milwaukee 12, Wis.

MICRO Precision Switches . . .

MICRO SWITCH
PATENT NO. 1,960,020
PAT. PEND.
MICRO SWITCH CORPORATION
FREEPORT, ILLINOIS U.S.A.
TYPE-Z
MS

MICRO BASIC SWITCH



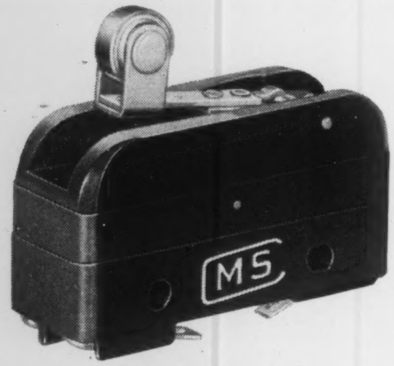
ACTUAL SIZE

● Not one switch—not two—but a COMPLETE LINE of switches from which engineers can choose the correct one with the exacting requirements to meet their specific needs. Exacting requirements demand precision switches and the MICRO line offers the most exacting—precise operating switches that are available today. This precision is possible because actuator and basic switch are integral.

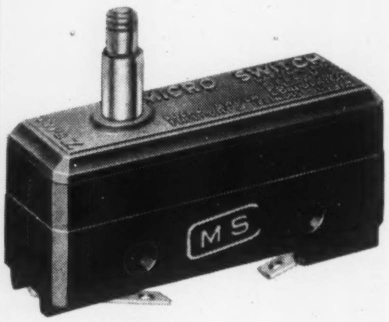
The MICRO Basic Switch, as shown, is precision made to give exact repeatability of operating point. Test after test by engineers of manufacturers using MICRO Precision Switches show that for precision and dependability these switches come out on top.

If in doubt—TEST. If you test, you'll use MICRO Precision Switches for precision and dependability.

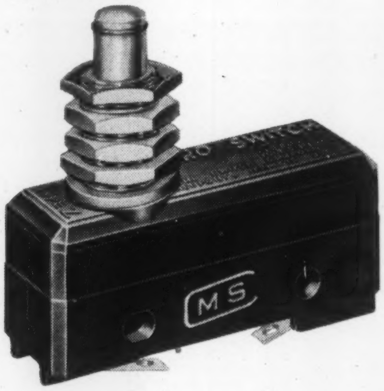
For complete information on any one or all switches, write or contact nearest branch or sales representative as listed below or MICRO Switch, Freeport, Illinois.



With "W22" Roller Lever Actuator—The "W22" Roller Lever Actuator is a part of the switch, not an attachment, for use in applications that require compact switch design. They are designed specially for actuation by rapid cams and similar fast moving devices.



With "S" Plunger Actuator—The "S" Plunger Actuated Switches are used as general purpose safety switches, as limit switches, and as control switches, where a small amount of overtravel in the plunger is desired. Applications include instruments and automatic machinery.

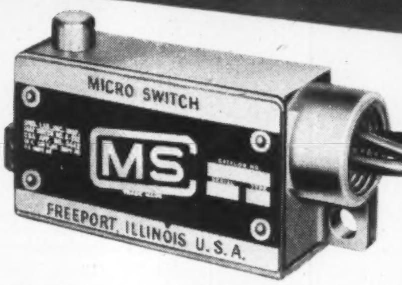


With "Q1" Plunger Actuator—The "Q1" Plunger Actuated Switches are panel mounting and are used as door switches, manual or mechanical push button switches in safety, limit or control applications. They are especially useful for applications where overtravel of actuating mechanism cannot be accurately controlled.

MADE WITH THE *"KNOW-HOW"* BEHIND MILLIONS OF PRECISION SWITCHES

. . . a Complete Line to Choose From

3,650 Characteristics
Sizes–Shapes–
Actuators
and Electrical
Capacities–


MICRO SWITCH
MS
FREEPORT, ILLINOIS U.S.A.

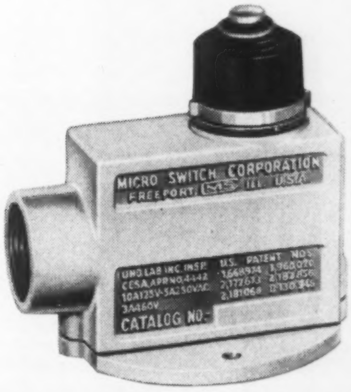
MICRO Precision "LN" Switch—Designed to meet the requirements of severe service as a limit, safety, or control switch in machine tools, and in packaging, canning, printing, and other machinery. It is resistant to splash of liquids (not immersion proof) and is sealed against dust or dirt.

MICRO SWITCH CORPORATION
FREEPORT, MS ILL. U.S.A.
CATALOG NO.

MICRO Precision BZV-2RN2 Switch—Designed with convenient adjustable arm and sealed plunger for operation by cam and slide. It is specially suited for use on machine tools and industrial equipment exposed to dirt and dust and occasional splash of oil or water.

EXPLOSION PROOF SWITCH
MICRO SWITCH FREEPORT, ILL. USA
MS
KEEP COVER ON TIGHT DISCONNECT FROM SUPPLY CIRCUIT BEFORE REMOVING COVER

MICRO Explosion Proof Switch—Underwriters approved for use in the presence of explosive atmospheres such as paint, varnish, starch, pyroxylin, and chemical factories, flour mills, and oil refineries. A heavy duty design for use as limits, safeties and interlocks where unprotected switches are not acceptable.


MICRO SWITCH CORPORATION
FREEPORT MS ILL. USA
CATALOG NO.

MICRO Die Cast Enclosed Switch—Designed with sealed plunger as part of switch for use in applications where oil, water, dust or abrasives are present and may come in contact with the switch. It is resistant to dust, oil, water, fruit acids and similar agents.

MICRO Precision Switches

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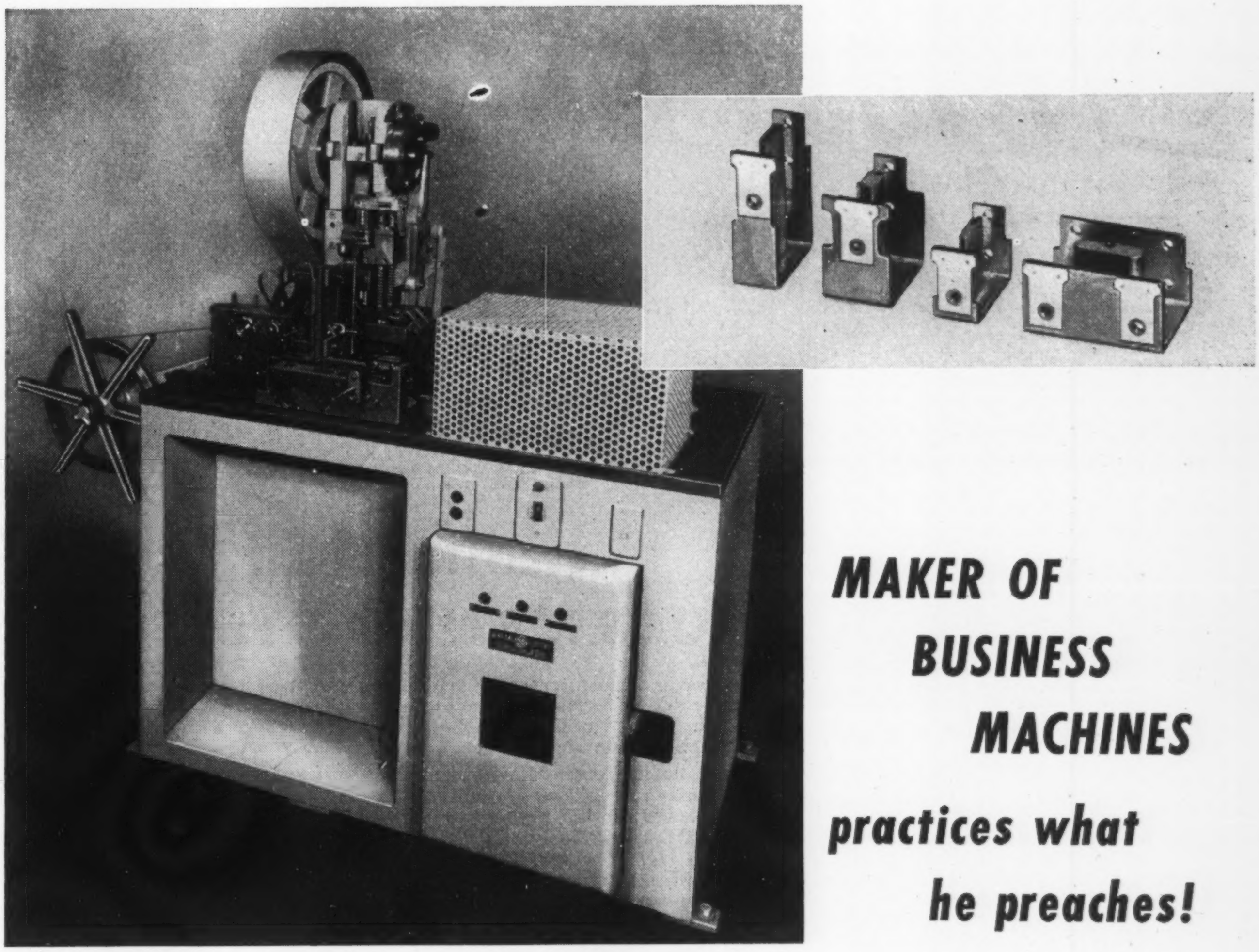

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Barth designed and built this 1 Machine to handle 3 Operations!

IT MAKES SENSE that a company whose progress and profits depend upon applying automatic machine operation to statistic, cost and other records, should also seek means for applying automatic operation to its own production.

This Barth designed and built automatic punch press and welding machine performs three operations . . . (1) it stamps out stainless steel residuals from .003" strip stock, (2) it assembles the residuals in position on armature core yokes which are magazine fed to the machine, (3) it completes the assembly with three simultaneous spot welds, employing fully automatic electronic welding heat and timing control as well as automatic assembly ejection.

A speed of 12 to 35 completed assemblies per minute is achieved and 4 sizes of core yokes can be accommodated.

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A Few of the Hundreds of Machines Now Equipped with LINCOLN Centro-Matic Lubricating Systems...

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LINCOLN

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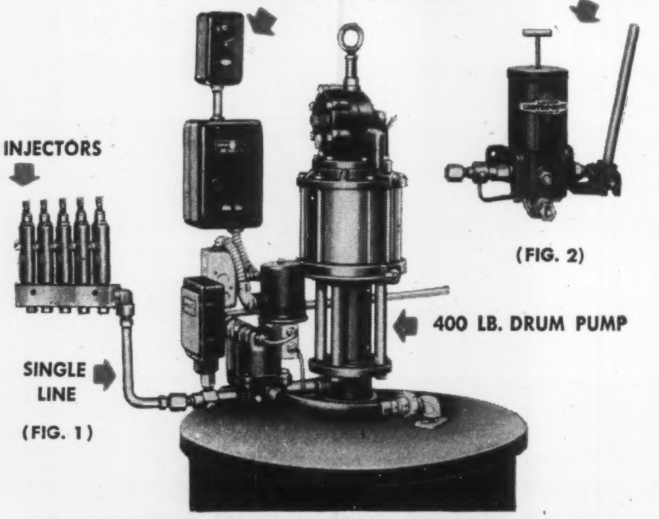
LUBRICATING SYSTEMS

Many manufacturers of machine tools and industrial equipment have adopted these outstanding lubricating systems as standard on their products. They assure positive lubrication with a metered quantity of lubricant to every bearing ... No "hit or miss" methods.

Lincoln Centro-Matic Systems are easy to install and consist of a number of injectors—one for each bearing, a lubricant pump and a single lubricant supply line from the pump to the injectors. The pump can be time clock or push-button controlled, power-operated (Fig. 1), or manually-operated (Fig. 2).

Lincoln Engineering Company maintains a staff of experienced lubrication engineers prepared to assist you in all lubrication problems. Write us, enclosing a blueprint or specifications of the machine you wish to lubricate and an unbiased recommendation will be made as to the Centro-Matic System best suited to do the job. This service is cost free.



(FIG. 2)

(FIG. 1)

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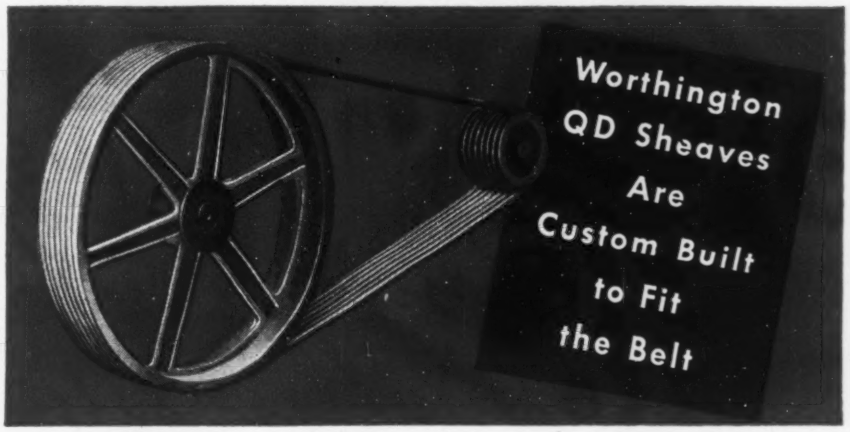
Pioneer Builders of Engineered Lubricating Equipment

LINCOLN ENGINEERING CO., ST. LOUIS 20, MISSOURI

FINEST LOOKING SHEAVE ON THE MARKET!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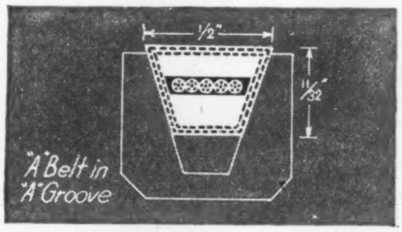
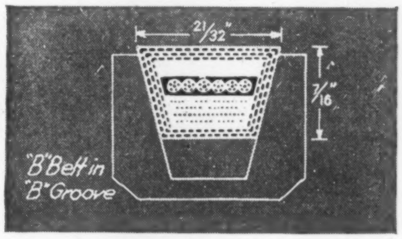
QD Sheaves
Are
Custom Built
to Fit
the Belt

You now have a choice of tailor-made sheaves to suit your V-Belt Drive requirements exactly!


1/2"
11/32"
"A" Belt in
"A" Groove

"A" Groove for "A" Belt


21/32"
7/16"
"B" Belt in
"B" Groove

"B" Groove for "B" Belt

GROOVED TO YOUR PREFERENCE — an "A" belt in an "A" groove, and a "B" belt in a "B" groove—custom built—"A" for "A" and "B" for "B" . . . "it looks right"—is what you want—and you get a better-engineered, better-fitting, better-looking drive.

In addition, you get the *original* tapered cone grip sheave design—the best combination of the three basic sheave requirements. 1. Easy to Get On—2. Easy to Get Off—3. Yet Always Tight on the Shaft.

The QD Sheave Clamps the Shaft Tighter than Any Other Sheave on the Market!

Note, too, the famous I-Beam Construction, providing strength where strength is needed most . . . The full-size pull-up bolts . . . The taper-mated hubs and rims . . . the offset design reducing overhang stresses . . . reasons why *there's more worth in Worthington.*

Ask your nearest Worthington District Office for complete details and for assistance in designing a Multi-V-Drive to suit your requirements. *Worthington Pump and Machinery Corporation, Merchandising Division, Harrison, New Jersey. 36 District Offices throughout the U.S.*

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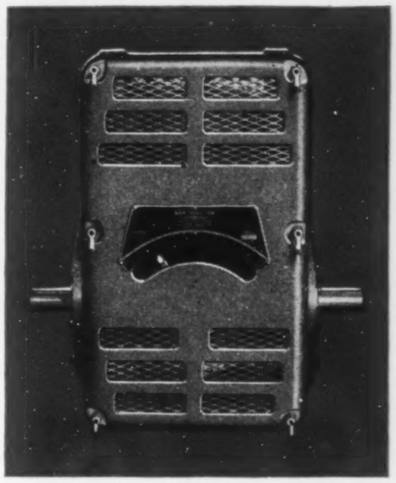
. . . Two More Allspeed Selectors Added by Worthington

YOU ASKED FOR THEM . . .
here they are—



Model D . . . 2 to 5 hp . . . 8-1 ratio . . . speed range 360/2880 (with 1725 RPM Input)

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NOW GET ALLSPEED ADVANTAGES in the full range from 1/4 hp to 7 1/2 hp . . . Models A and C for lower horsepowers . . . D and E for higher horsepowers. All have these outstanding features . . . Tandem belt drive for compactness . . . automatic belt tensioning . . . quick belt change . . . wide selection of speed ratios.

Ask your nearest Worthington District Office for your copy of the Worthington Allspeed Selector Bulletin, and for help in choosing the right selector for your job.

Worthington Pump and Machinery Corporation, Merchandising Division, Harrison, New Jersey. 36 District Offices throughout the U.S.

WORTHINGTON

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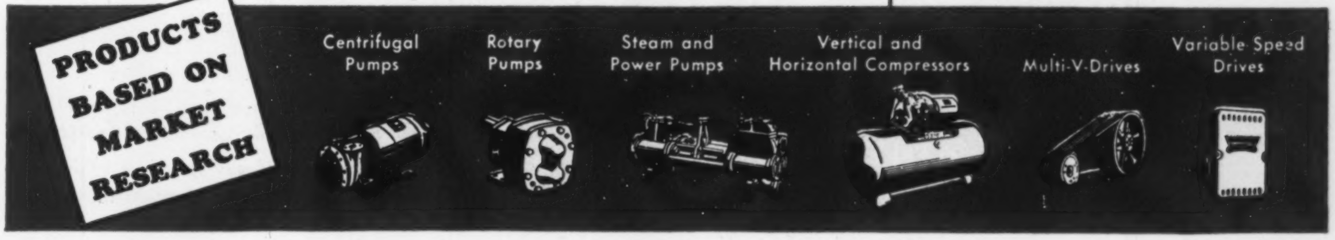
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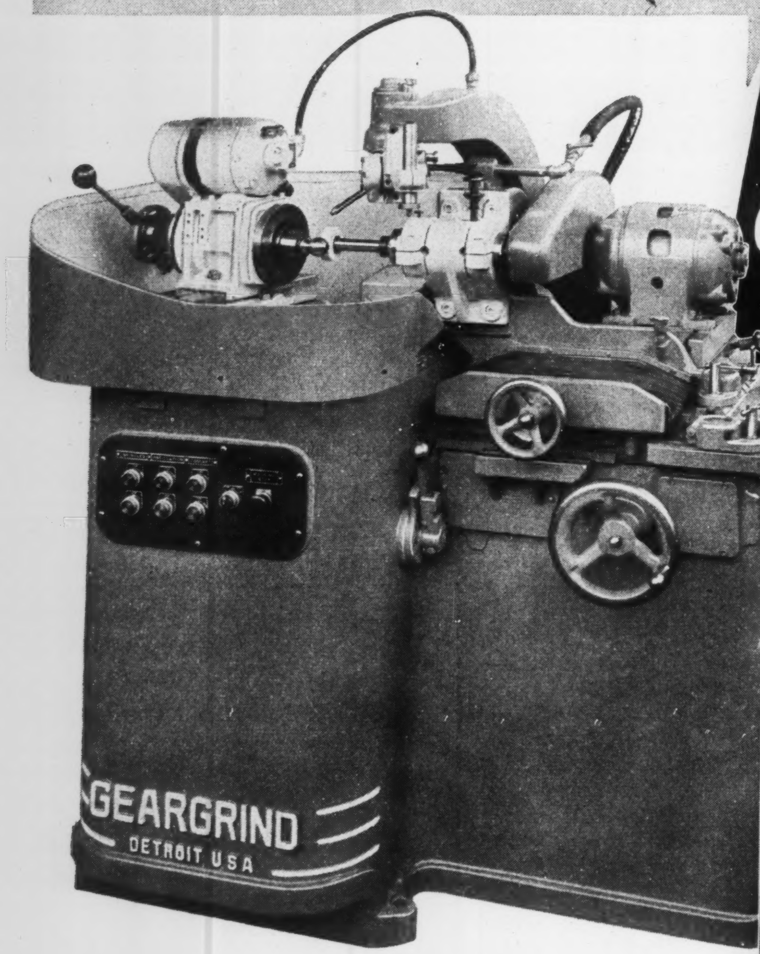
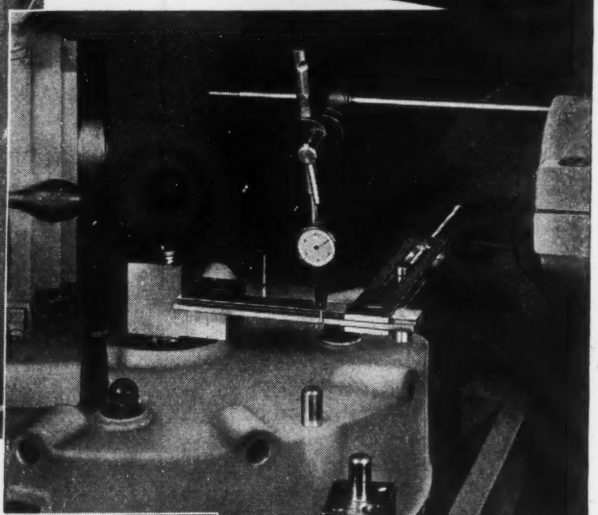
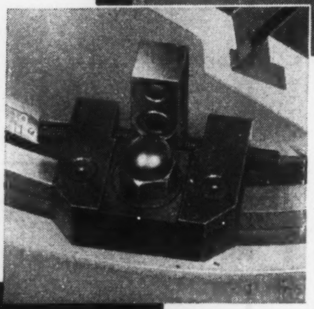




This versatile machine, displayed for the first time at the Machine Tool Show, grinds external and internal cylindrical surfaces, generated or formed spherical external and internal surfaces, external conical surfaces, internal tapers, ball bearing races and fillets.

With a single set-up combinations of the above may also be ground, securing perfect blending of straight and curved surfaces and extreme accuracy.

Sine bar arrangement in place, showing method of setting work-head at any predetermined angle.



Worktable clamping device, with micrometer adjustment.

The GEAR GRINDING MACHINE COMPANY
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Illustrates many set-ups and gives full information and specifications.

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—with the BRUNING BW Direct Line Printing Process!

—EASY to have BW prints in seconds!

Original tracings—office and order forms—specifications—bulletins—made on translucent or transparent paper—are reproduced in seconds with the Bruning BW Direct Line Printing Process. You get positive, black line prints, without the use of a negative. And you can make Bruning BW Prints *anywhere* in your plant or office—for Bruning BW equipment produces no irritating fumes which must be exhausted—requires no plumbing—is clean, quick and simple.

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In addition to regular BW Prints (black lines on white backgrounds) you can make BW colored line prints with brown or red lines on a white background, or with black, brown or red lines on a green or pink tinted background. These colored line prints make it possible to distinguish prints used by different departments, or prints used in various stages of product development.

—EASY to add New Details on prints!

Altering original designs—without changing your original tracings—is simple if you use Bruning BW Transparents. Simply make a BW Transparent from your original—eliminating unwanted portions with BW eradicator. New details may then be added on the BW Transparent and subsequent BW Prints made from the Transparent will bear these changes.

—EASY to make Card-weight or Cloth Prints!

When you need more durable prints for shop use—or want to reproduce charts, graphs, etc.—use Bruning Card-weight BW Prints. Card-weight Prints are easily colored with water colors, ink, crayon or pastel. You can also have Bruning BW Cloth Prints for binding into plat books and BW Extra thin Prints for mailing purposes! These are only a few of the many kinds of prints which the BW Process offers you.

Bruning Model 91 BW Volumatic Printer-Developer, one of many Bruning BW machines.

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Designer's

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H1
H2
H3
H4
X2
X1

Yes, here at last is a line of transformers designed specifically for machine tool use. We didn't guess at what you wanted in such transformers. We asked machine-tool designers throughout the country. This new line of G-E machine tool transformers is the result. It incorporates every practical suggestion your profession had to offer.

A COMPLETE RANGE OF RATINGS. Ten ratings, from .075 to 3 kva, 60 cycles, 220/440 volts will meet most of your domestic requirements. For foreign and unusual domestic applications, the line includes an all-purpose group of transformers rated 50/60 cycles, with eight primary taps from 208 to 550 volts. Also available are 25-cycle units in four standard sizes from .150 to .5 kva, with primary taps for 220, 440 and 550 volts.

HARMONIOUS APPEARANCE. The trim good looks of these transformers harmonizes with other modern components to make neat, functional control-panel arrangements.

VOLTAGE REGULATION. Regulation characteristics have been given careful attention to assure satisfactory operation of motor-starting relays which cause heavy momentary overloads. Hence, there is no need for use of greatly oversized transformers to handle momentary surges. To help you select the right transformer, see the complete regulation data in our new machine tool transformer bulletin.

OVERLOAD PROTECTION. These transformers have a built-in overload protector, with time-delay action, to prevent damage under sustained overload or accidental short circuit.

EASY TO INSTALL. With the diagrammatic nameplate, errors in connection are avoided. Only a screw driver is needed to make solid connections on the front-mounted terminal board. Molded-plastic terminal barriers prevent accidental shorts. These new transformers save space, save installation time, and reduce inventories. For full information ask for Bulletin GEA-4887.

GENERAL ELECTRIC

Digest

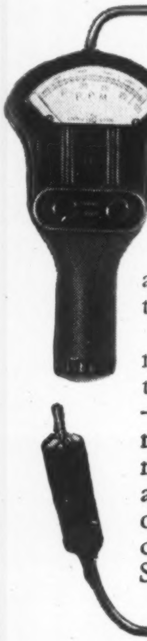
TIMELY HIGHLIGHTS ON PRODUCTS

SOLENOIDS ARE BACK

This General Electric a-c solenoid is *not* new, but it is currently being built in increasing quantities . . . shipments are short enough now so that you can safely include it in your new designs. The performance record of these units is responsible for their popularity among machine designers.

Any straight-line push or pull, from 0.9 to 97 pounds, is easy for this industrial solenoid. It may be operated remotely from a push-button station, or automatically by limit switches, pressure switches, float switches, or other pilot circuit devices. Check Bulletin GEA-2080 on coupon.

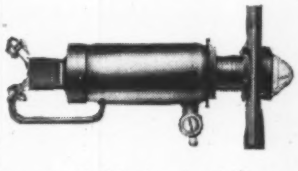
VERSATILE HAND "TACH"



Here's a new hand-held electric tachometer for checking performance on your machines. It measures rotational speed in three ranges from 100 to 10,000 rpm; and linear speed in six ranges from 10 to 10,000 fpm. With accessories, you can measure speeds from 10 to 100,000 rpm.

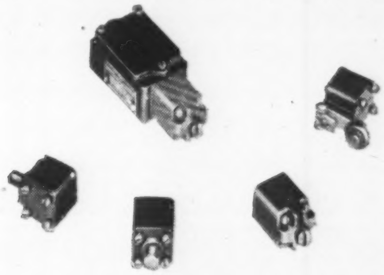
Accuracy of ± 1 per cent is unaffected by magnetic fields, machine vibration, or temperature. Scale is large and easy to read—with no crowding on any range. Speed ranges can be changed while spindle is rotating—and instrument can not be damaged by overspeeding. Requires only ¼ ounce-inch driving torque. Measures both clockwise and counterclockwise rotation. See Bulletin GEA-4895.

NEW INDICATING LAMP



The new Type ET-5 indicating lamp is designed to harmonize with modern panel instruments and to give high visibility from any angle. Caps are available in six fast colors. Series resistor limits current in lamp circuit, eliminating need for low current fuses. Two types: for panels up to ¼ inch thick and for panels up to 2 inches thick. Check Bulletin GEA-3643.

For positive snap action:
TYPE K-1 LIMIT SWITCH



You can specify any one of four different heads—roller-lever, side push-rod, top push-rod, roller push-rod—on the General Electric Type K-1 snap action limit switch. And you have a choice of four head positions . . . that's real versatility. Snap action means sure, positive operation; contacts always open at the same point.

Cutting fluids and oil will not damage these switches, thanks to oilproof construction. They are physically small (approx. 1½x3½x1⅜ inches), yet handle up to 10 amps at 110/220 volts a-c. Bulletin GEA-4644.

Type J-1 Snap-action Limit Switch, big brother to the Type K-1, is rated 10 amps at 110 volts and will interrupt up to 30 amps. These general-purpose limit switches have gained wide acceptance in industry—are noted for their reliability, ease of installation and versatility of application. Available now! Bulletin GEA-4643.

GENERAL ELECTRIC COMPANY
Apparatus Dept., Section B 668-57, Schenectady 5, N. Y.

Please send me the following bulletins:

☐ GEA-4887—Machine-tool Transformers
☐ GEA-3643—Type ET-5 Indicating Lamp
☐ GEA-4895—New Hand Tachometer
☐ GEA-2080—Solenoids
☐ GEA-4644—K-1 Limit Switch
☐ GEA-4643—J-1 Limit Switch

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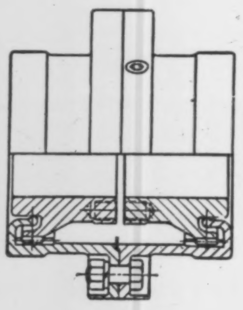
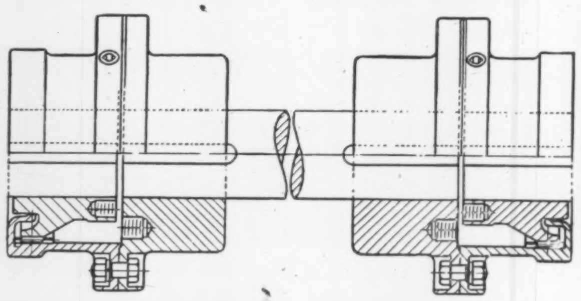

STANDARD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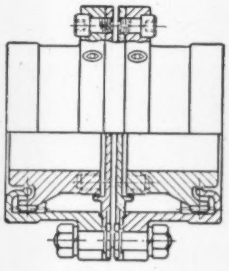
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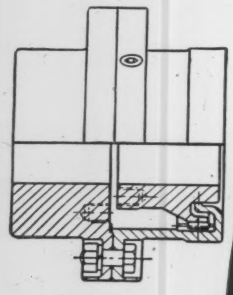
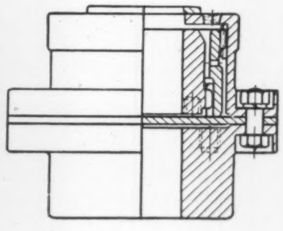

SINGLE ENGAGEMENT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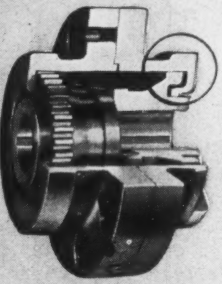

ALL - STEEL CONSTRUCTION! NO PERISHABLE PARTS! Those statements apply to Fast's self-aligning couplings — uniquely designed to give you uninterrupted power transmission. The *exclusive* "rocking bearing" (circled) is an example of Fast's thoroughness. It provides a positive metal-to-metal seal for the load-carrying oil, permanently protecting it against moisture, dust and grit. No perishable packing rings are used. There's nothing to wear, nothing to fail. ¶ Years of engineering experience, Koppers' high standard of workmanship and unexcelled coupling service pay off in longer machine life, lower upkeep costs and minimum shutdown losses . . . when you choose your Couplings from Fast's big, complete line. Prompt delivery. Write for our catalog to: Koppers Co., Inc., Fast's Coupling Dept., 250 Scott St., Baltimore 3, Md.

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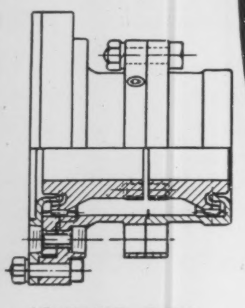
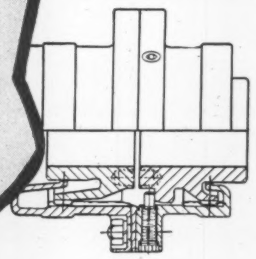
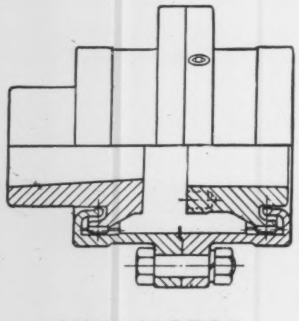
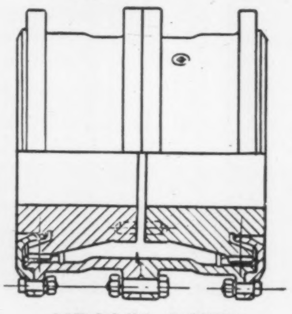
self-aligning
COUPLINGS


SHEAR PIN


CUT-OUT


MILL MOTOR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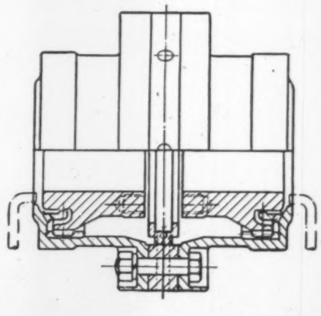
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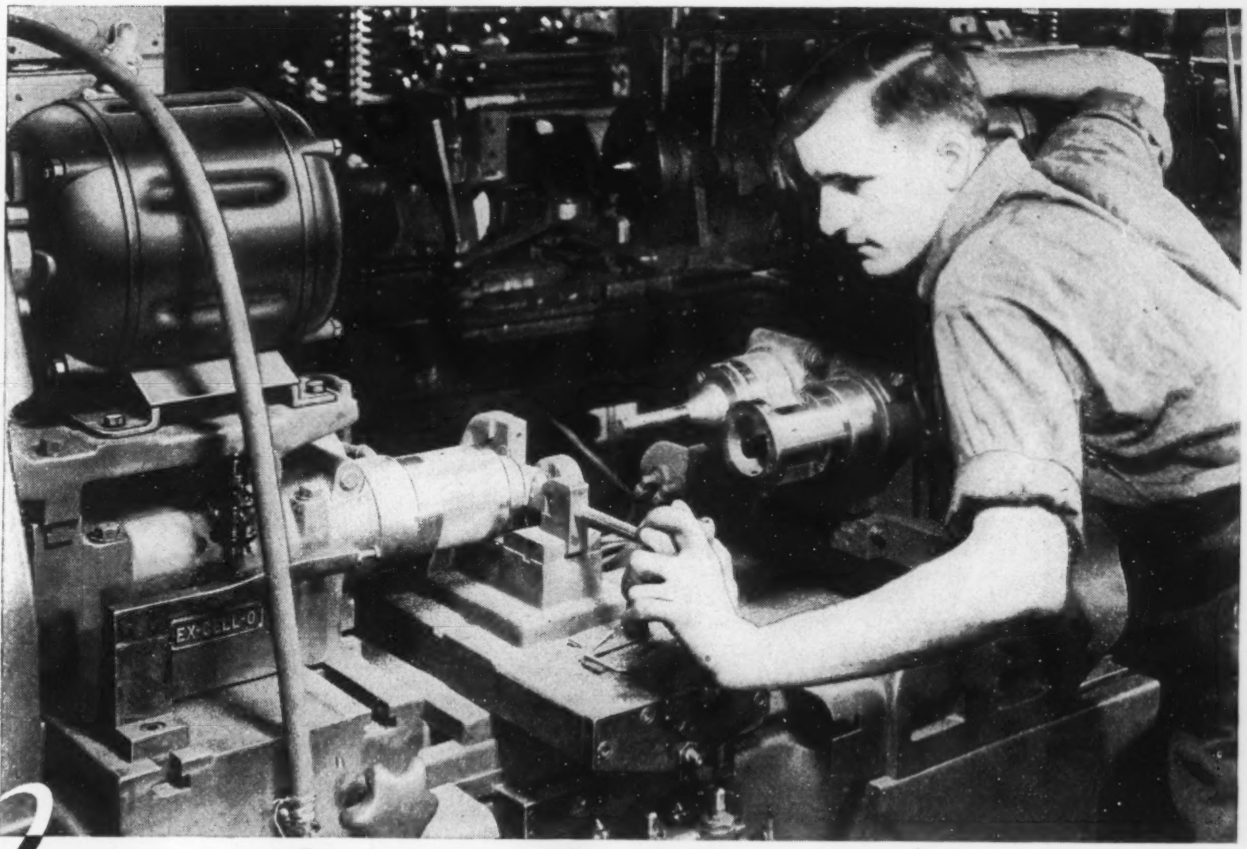

Quiet, Smooth Performance that's what WAGNER *Quality* MOTORS give your Machine Tools

Wagner Quality Motors make a close machining job as easy as eating apple pie. They run "smooth as silk" and give performance that enhances the value of the machine tools they are driving.

Because of smooth performance you find hundreds of thousands of Wagner Quality Motors on the job driving all types of industrial machines and equipment . . . That's why so many manufacturers have standardized on Wagner Motors. If you manufacture or use motor driven equipment Wagner can furnish the "RIGHT" Motor for your purpose. Users of Wagner motors also profit by our quick, convenient, nationwide service facilities. Twenty-nine branch offices, located in principal cities, are ready to give you service and advice. Contact our nearest office, or write Wagner Electric Corporation, 6404 Plymouth Ave., St. Louis 14, Mo., for bulletins on the complete line.

The Wagner line of polyphase and single phase motors is diversified to meet all machine tool requirements. Open-type and totally-enclosed non-ventilated motors are available with sleeve or ball bearings; totally-enclosed fan-cooled motors are built with ball bearings only.

Consult Wagner Engineers on all Electric Motor Problems

Wagner Electric Corporation
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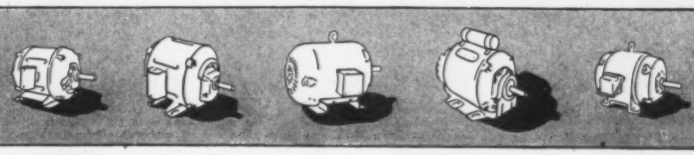

M47-19

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Keuffel & Esser Co. is proud to have played so large a part in making such instruments widely available. In this way K & E equipment and materials have been partners of the engineer and draftsman for 78 years in shaping the modern world. So universally is this equipment used, it is self-evident that K & E have played a part in the completion of nearly every engineering project of any magnitude. Could you wish any surer guidance than this in the selection of your own "partners in creating"?

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1947 MACHINE TOOL SHOW

MACHINE TOOL SHOW
MT
CHICAGO SEPT. 17-26

1947 MACHINE TOOL Electrification FORUM

WESTINGHOUSE
W

MORE PRODUCTIVE POWER *For Industry*

A thousand new tools for industry . . . a thousand examples of joint effort in powering modern machines that will mean "more goods for more people at lower cost."

Many of the advances in design and performance of the modern machine tools displayed at the 1947 Machine Tool Show at Chicago are the result of advances in the design and application of the drives and controls.

Westinghouse has played a prominent part in these developments. The Annual Westinghouse Machine Tool Electrification Forum has been the common meeting place for discussions of the problems of the Machine Tool Industry for eleven years. It has brought top-flight machine tool engineers together with Westinghouse research and design engineers for frank and complete discussions of their problems.

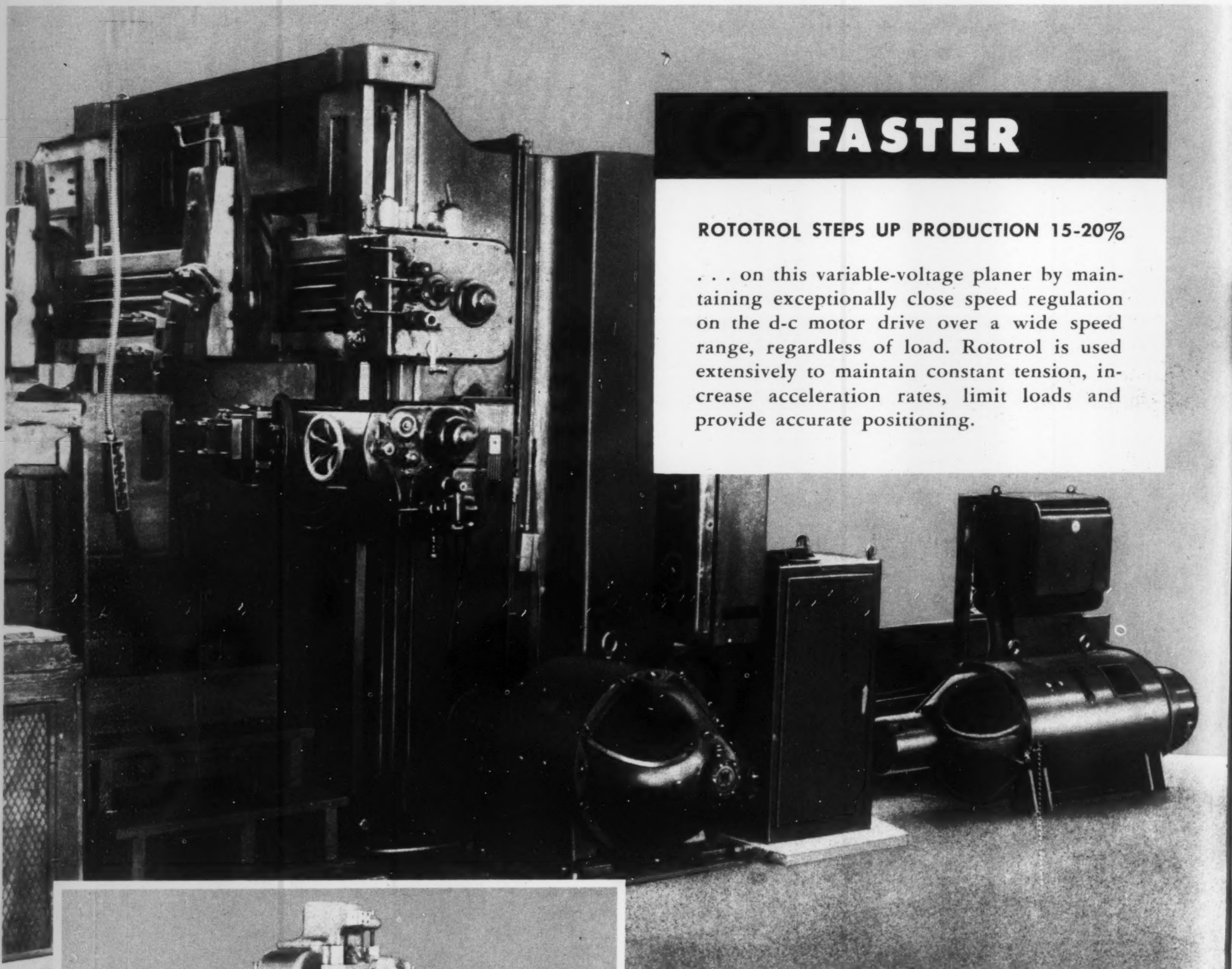
Many of the drives and controls on today's modern machine tools are the result of these combined engineering discussions. No wonder then that more than 75 percent of the machine tool manufacturers exhibiting at the Chicago show are users of Westinghouse equipment.

A few of the reasons why it pays to look and ask for Westinghouse electrified machine tools will be seen on the following pages.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

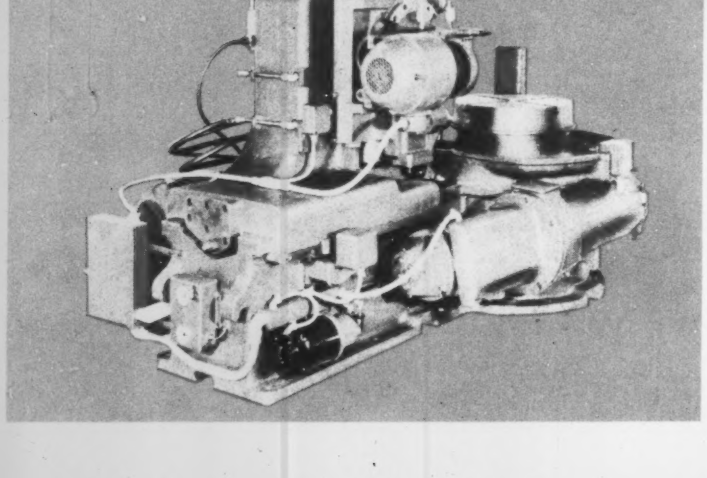
Here's how MODERN DRIVE *are being used* TO GET MORE PRODUCTIVE POWER FROM



FASTER

ROTOTROL STEPS UP PRODUCTION 15-20%

. . . on this variable-voltage planer by maintaining exceptionally close speed regulation on the d-c motor drive over a wide speed range, regardless of load. Rototrol is used extensively to maintain constant tension, increase acceleration rates, limit loads and provide accurate positioning.



ELECTRONICALLY CONTROLLED, ADJUSTABLE-SPEED MOTOR SOLVES MILLING PROBLEM

Building a machine to mill the irregular surface of a steel propeller barrel so that finish was accurate and uniform all over, was solved by this lathe maker and Westinghouse engineers with an adjustable-speed drive. Electronic control governs the feed rate of the cutter with extreme precision, maintaining uniform finish and converting painstaking manual regulation into production-boosting automatic control.

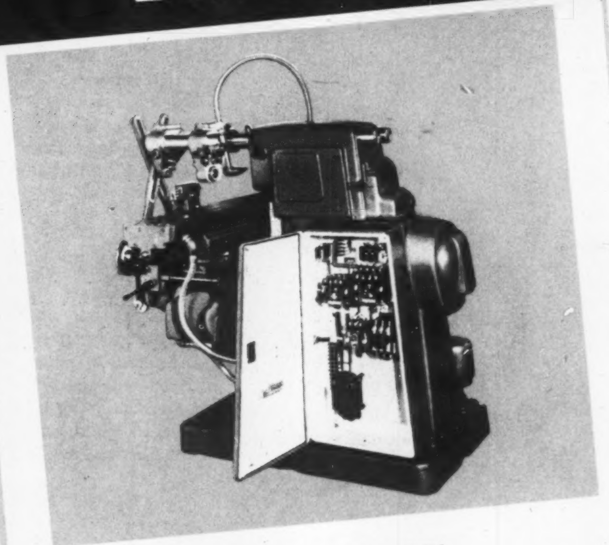
METHODS

MODERN MACHINE TOOLS

Greater precision, compactness, simplification of functions, less maintenance, higher quality of finished product . . . these are important dividends of modern drive methods applied to modern machine tools.

The examples here are just a few where Westinghouse developments in improved drives and controls provide *more productive power* . . . offer ways to produce better, faster, cheaper.

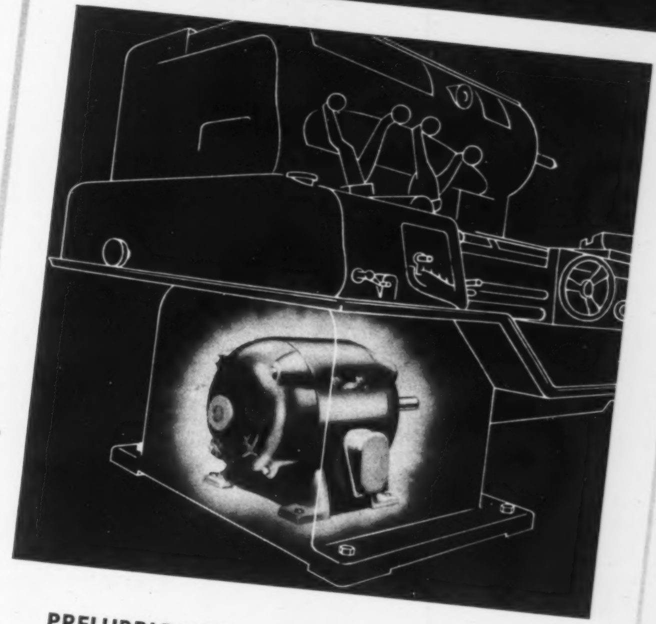
BETTER



MODERN CONTROL MEETS MODERN DESIGN NEEDS

Modern built-in electrical control contributes to appearance and general efficiency of machine tools, too. Enclosures built to blend with machine lines eliminate protruding units . . . minimize floor space needs.

CHEAPER



PRELUBRICATED LIFELINE MOTOR DRIVES CUT MAINTENANCE COSTS

Meet the motor you can install in 1947 . . . and forget until 1952! It's the new Westinghouse LIFELINE Motor, with prelubricated ball bearings that require no greasing for five years or more.

Where motors must be mounted in hard-to-reach places, as is sometimes necessary in machine tools, prelubrication means substantial savings in maintenance costs. Design engineers are given new freedom, too, in locating motors for maximum efficiency instead of accessibility or ease of lubrication.

In addition, LIFELINE motors give the advantages of less space per hp than any other standard motor, rugged all-steel frame, improved windings and new quietness and smoothness.

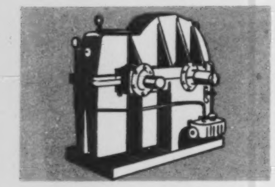
FOR MORE PRODUCTIVE POWER . . . *LOOK TO*

Westinghouse

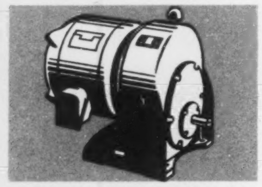
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

FOR MORE INFORMATION ON HOW TO MAKE POWER MORE PRODUCTIVE TURN PAGE →

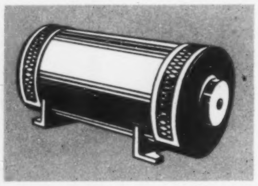
FOR ANY DRIVE PROBLEM Westinghouse OFFERS THE RIGHT EQUIPMENT..APPLICATION HELP



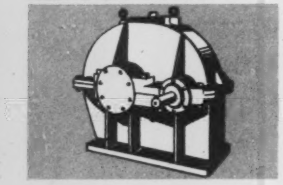
Speed increasers (Type SU) are produced in three basic styles comprising a total of 30 sizes. Small units have nine sizes from 1.25:6.50 to 1.25:-12; large units have 12 sizes from 1.25:9 and 2.00:8 to 1.25:12 and 2.00:12.



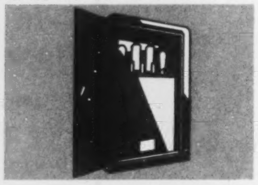
Gearmotors are available in three types—Type A, single-reduction with gear ratios from 1.22 to 6.25; Type C, double-reduction with gear ratios from 7.61 to 25.7 and Type E, double-reduction with gear ratios from 31.2 to 58.3.



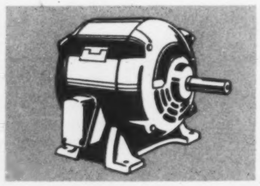
Rototrol for modern control systems where one or more of the following functions are to be controlled: speed, load, torque, acceleration or power factor.



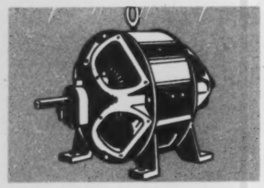
Speed reducers, in single and double-reduction units, have ratios from 2.82:1 to 9.5:1 and 11.8:1 to 70.5:1. All are external-geared type with shafts in horizontal plane.



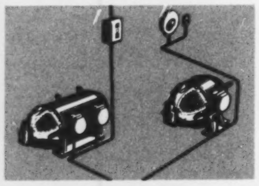
Mot-O-Trol electronic drives provide accurate speed control over a wide speed range from single or three-phase, a-c power. Ratings range from 1 to 10 hp.



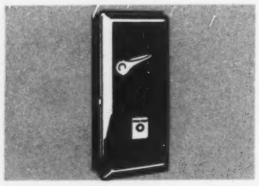
Life-Line motors—the greatest advance in motor design in 58 years—are built in 1 to 200-hp ratings, two and three-phase, for voltages of 208, 220, 440 and 550.



D-C motors—Type SK—a complete line of standard sizes, 1 to 200 hp, frames 204 and larger, 115-230 or 550 volts



Adjustable-speed, a-c drives have hp ratings of 1 to 15, inclusive, for 220-440 or 550 volts, 2 or 3-phase, 60-cycle operation. Speed range 10:1.



Combination Linestarters, Class 11-206, provide complete motor and circuit protection in one enclosure for motors up to 200 hp.

Mail coupon for more information

Westinghouse Electric Corporation
P. O. Box 868
Pittsburgh 30, Penna.

Please send me more information on the following products:

☐ **Speed increasers**
☐ **Speed reducers**
☐ **Gearmotors**
☐ **Mot-O-Trol**
☐ **Rototrol**
☐ **Life-Line motors**
☐ **D-c motors**
☐ **Adjustable-speed, a-c drives**
☐ **Combination Linestarters**

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Title____

Address________________ City________________ State________

J-90580

APPLICATION ENGINEERING

The how-to-do-it ability of trained Westinghouse engineers is ready to help solve your plant power problems. Co-operative engineering service demands both an aggressive imagination and broad experience in applying basic principles of electricity and allied equipment. Both of these are part of Westinghouse Engineering Service.

RESEARCH

The scope of Westinghouse research reaches into every industry. Wherever power is used and distributed, this research has played an important role in doing jobs better, faster, cheaper.

Westinghouse research facilities are available at any time to help you use the new production tools and apply scientific knowledge in finding practical solutions to production problems.

TRAINING MATERIAL

Westinghouse training material includes not only instruction courses in such subjects as electronics and resistance welding, but everyday help in all phases of the operation and maintenance of modern electrical equipment. This help is available in the form of printed literature and training films. Ask your nearest Westinghouse office for further information.

MAINTENANCE

Westinghouse Maintenance Service, for field and shop repairs, includes a nationwide chain of 34 Manufacturing and Repair Plants. A skilled corps of specialists located at your nearby Westinghouse office is ready to help you at any time.

RENEWAL PARTS

Parts Warehouses in 29 cities carry genuine Westinghouse renewal parts, and Westinghouse distributors—in addition to their own stocks—can secure parts promptly from any warehouse.

WESTINGHOUSE W

PRODUCTIVE POWER

Litho in U. S. A.

high ratios?

✳ ONE OF 93

DE LAVAL
DOUBLE REDUCTION
WORM GEARS

De Laval double reduction speed reducers, consisting of combinations of double worm gear reductions, or helical and worm gear reductions, are available with overall ratios up to approximately 8000 to 1. De Laval single reduction worm gear speed reducers are available in ratios up to 90 to 1. If high ratios are your requirement, worm gear speed reducers are the answer—particularly if space is limited and reliability is important. A De Laval representative will help you pick the right size and type.

✳ This double reduction De Laval Worm Gear Speed Reducer is available in many standard ratio combinations, with horizontal or vertical output shafts and is but one of 93 sizes of standard De Laval Worm Gear Speed Reducers.

DE LAVAL

***Worm Gear Division* — De Laval Steam Turbine Company, Trenton 2, N. J.**

Atlanta • Philadelphia • Charlotte • Pittsburgh • Cleveland • Rochester • Detroit • San Francisco • Chicago New York • Denver • Kansas City • Helena • Boston • Houston • Washington, D. C. • St Paul • Los Angeles • New Orleans • Seattle • Salt Lake City • Tulsa • Edmonton • Winnipeg • Toronto • Vancouver

WG-14

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

Plan for a

DROP in maintenance costs

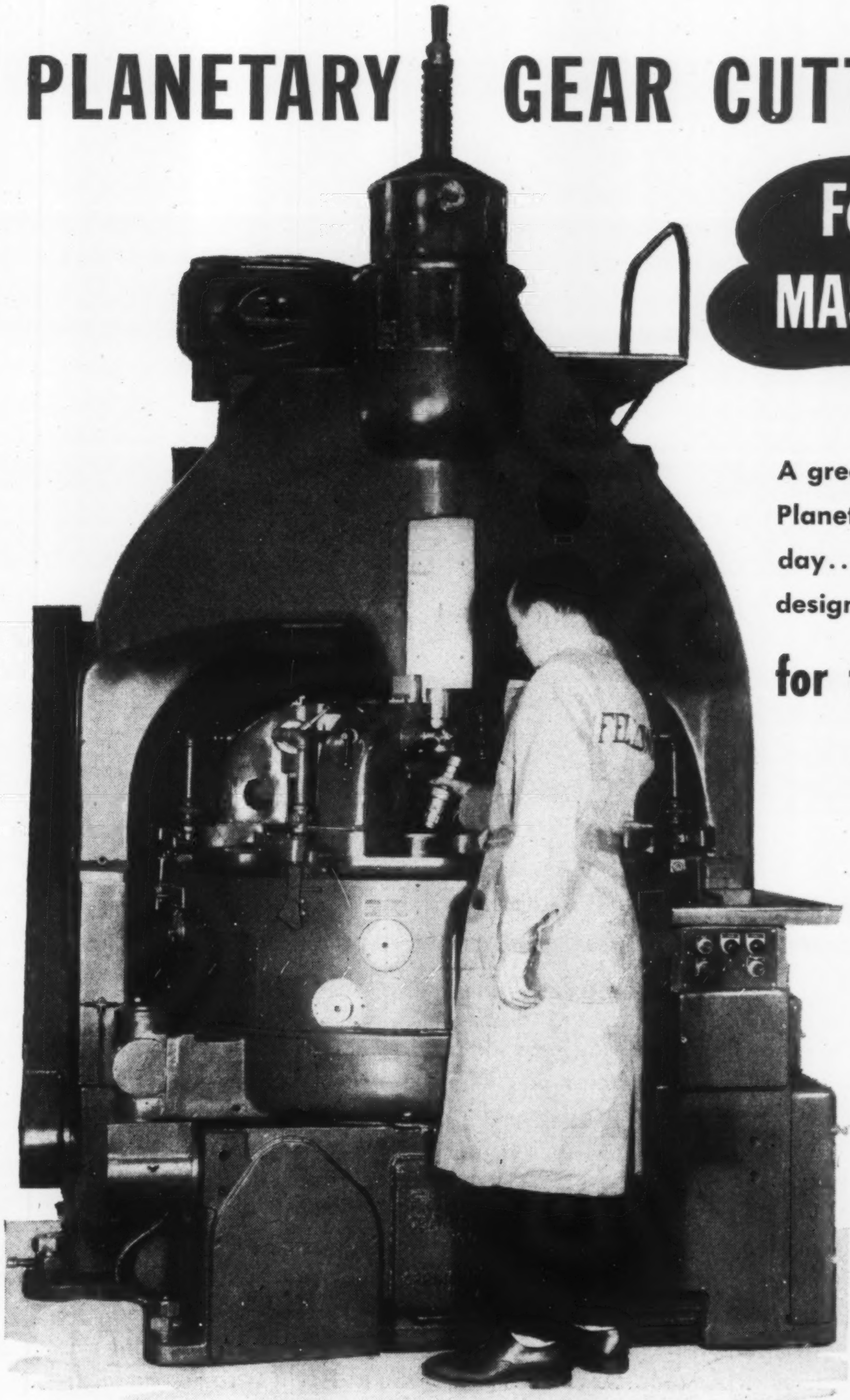
Maintenance is an important factor, and must be given ample consideration in designing machine drives.

To minimize maintenance costs, choose chains—time-tested Whitney Roller Chains. In most services, the maintenance problem is nothing that just a little oil won't solve.

Parts are durably made—durably assembled—can be relied upon to deliver full-rated machine capacity and to withstand shocks and overloads in hard and continuous service . . . It pays to standardize on Whitney.

THE WHITNEY CHAIN & MFG. CO., HARTFORD 2, CONNECTICUT

WHITNEY ROLLER CHAINS



PLANETARY GEAR CUTTING

For Precision MASS PRODUCTION

A great new Fellows machine tool—the Planetary Gear Shaper—heralds a new day... permitting new standards in the design of gears for high production.

for the Designers' Interest

- ★ Gear Shaper precision permits designing to closer tolerance specifications.
- ★ Gear Shaper precision in pre-shaving also permits cutting down stock removal, and decreases tool wear in the shaving operation.
- ★ Gear Shaper method permits economical one-piece design of cluster gears.
- ★ High-speed progressive cutting greatly reduces the cost per piece.

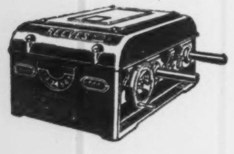
Write for a new descriptive bulletin of operating principles and production rates. The Fellows Gear Shaper Co., Head Office and Export Dept., Springfield, Vermont. Branch Offices: 616 Fisher Bldg., Detroit 2; 640 West Town Office Bldg., Chicago 12; 7706 Empire State Bldg., New York 1.

Fellows

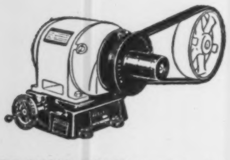
THE FELLOWS METHOD...MACHINES AND TOOLS FOR ALL OPERATIONS FROM BLANK TO FINISHED GEAR

Be right---
with REEVES!

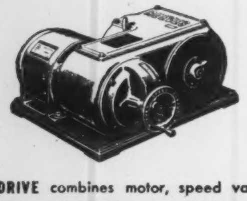
THE 3 BASIC REEVES SPEED CONTROL UNITS



VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR FULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

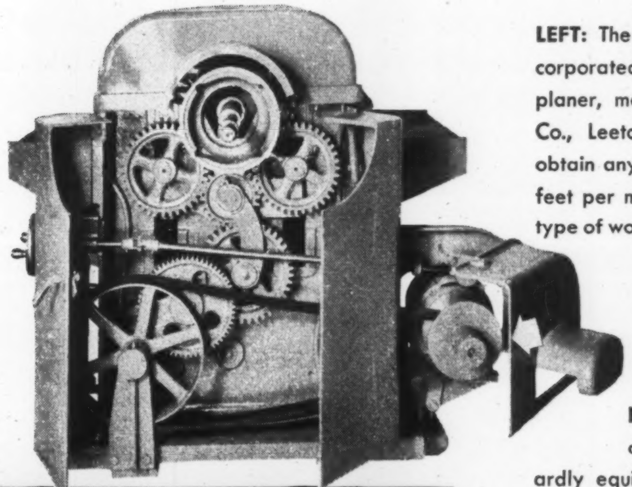
For the machines you build, REEVES Speed Control is the proved means of providing the right speed for every job . . . under every changing condition

In Industry's never-ending race for increased production and improved quality, one factor consistently enables certain machines to out-produce all competition. That factor is the accurate, infinite *speed adjustability* provided by REEVES Speed Control . . . assuring exactly the right speed for every operator and every operation—under every changing condition.

Today, REEVES Variable Speed Drives are standard equipment on more than 2100 different makes of machines. And in the 25,000-odd widely diversified plants where these REEVES units are located, the day-after-day production record of REEVES-equipped machines is ample evidence that the REEVES way is the RIGHT way to assure maximum output of top-quality products—at minimum manufacturing cost!

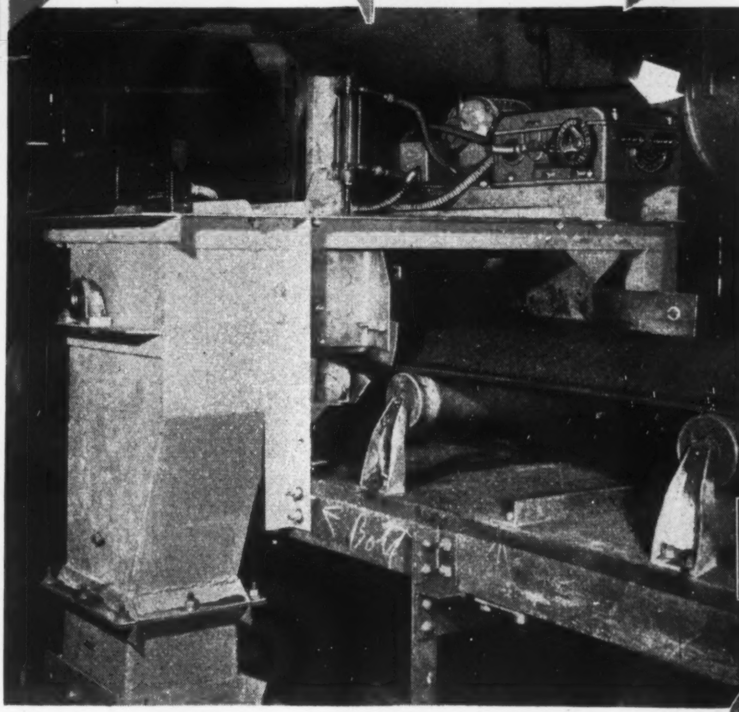
The complete REEVES line of rugged, easy-to-maintain speed control equipment includes the widest variety of designs, sizes, speed ratios and controls, the latter including manual, push button and completely automatic. Internal operating parts of REEVES units also are furnished for incorporation within the framework of the machines you build. An experienced REEVES Speed Control engineer will be glad to consult with you on the unit best fitted for your particular requirements. Write for the name of the REEVES representative nearest you. Ask for the 114-page Catalog H-450A, giving complete details on the entire REEVES Speed Control line.

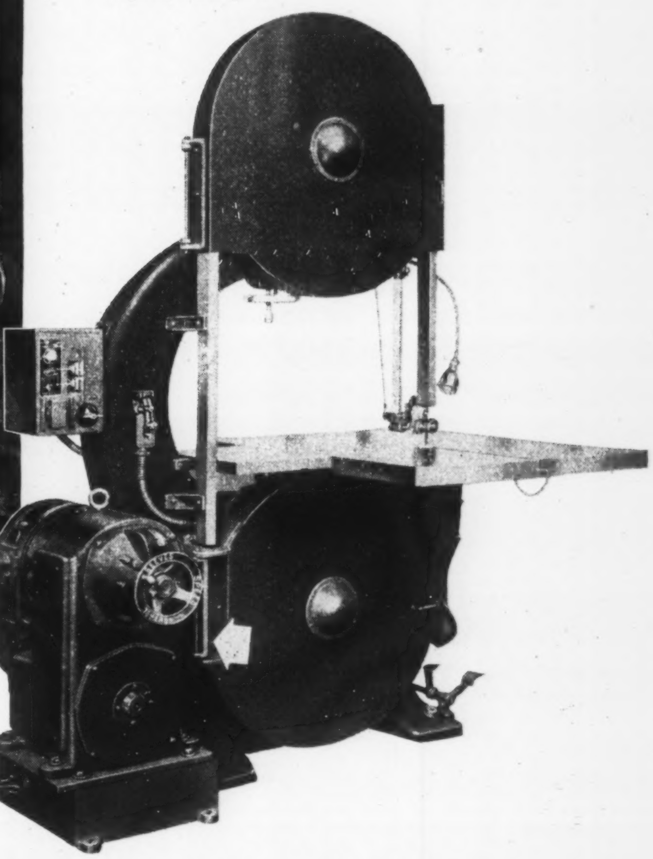
REEVES PULLEY COMPANY • COLUMBUS, INDIANA



LEFT: The REEVES Vari-Speed Motor Pulley incorporated within the framework of this P-24 wood planer, manufactured by the Crescent Machine Co., Leetonia, Ohio, enables the operator to obtain any desired rate of feed—from 20 to 60 feet per minute—as determined by the size and type of wood being worked.

BELOW: Thanks to the REEVES Motodrive with which this band saw is standardly equipped, the operator can instantly obtain the exact speed required to cut such widely diversified materials as wood, aluminum, zinc, rubber, plastic, porcelain or tool steel. Saw is manufactured by the Tannewitz Works, Grand Rapids, Michigan.





ABOVE: This Airator Power Plow, manufactured by the PeKay Machine and Engineering Company, Chicago, delivers a constant supply of free-flowing sand for a molding machine in a large automobile plant. The REEVES Variable Speed Transmission with which the plow is equipped drives a ribbon flight which must carry sand from conveyor to hopper in constantly changing amounts.

Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

Recognized Leader in the Specialized Field of Speed Control Engineering

How Cooling Requirements Calling For A Compact, Lightweight, Versatile Unit

ARE FILLED PROMPTLY FROM STOCK

Widespread use of small, lightweight Ross "BCF" oil and water coolers for Diesels, compressors, hydraulic presses, torque converters, reduction gears and turbines REQUIRES MASS PRODUCTION OF PARTS AND ASSEMBLY LINE METHODS to keep current with the needs of industry.

Thus, quantities of those sizes in greatest demand are carried in stock for immediate shipment.

Save time! Save costs! Check with your nearest Ross representative (or the main office) on filling your requirements from stock. Our Monday morning stock lists show how many of each size can be shipped within 24 hours . . . and you'll be quoted from published price and discount lists.

- √ *STRONG, DURABLE*
- √ *CORROSION RESISTANT*
- √ *ALL NON-FERROUS MATERIALS*
- √ *HIGH HEAT TRANSFER RATE*
- √ *EASILY INSPECTED AND CLEANED*
- √ *SIMPLE TO INSTALL*

ROSS

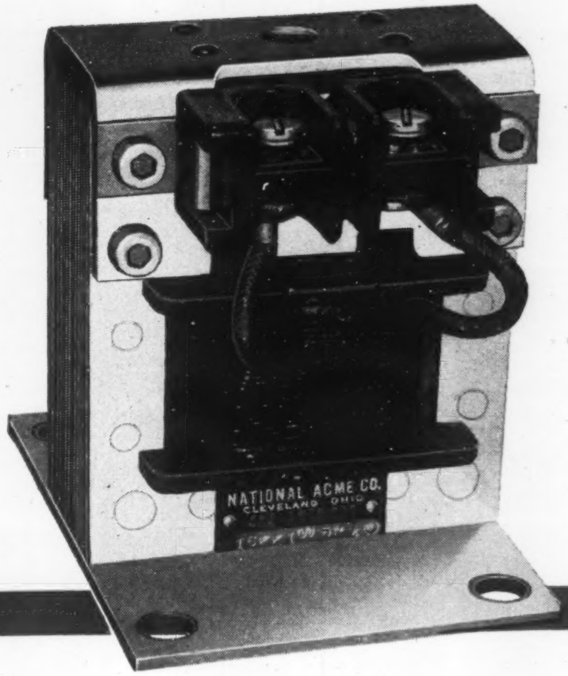
'BCF' COOLERS

ROSS HEATER & MFG. CO., INC.

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

1429 WEST AVENUE **BUFFALO 13, N. Y.**

Ross Equipment Is Manufactured and Sold in Canada by Horton Steel Works, Ltd., Fort Erie, Ontario



SOLENOIDS
ENGINEERED for AUTOMATIC OPERATION

Five years ago no one dreamt of using solenoids for the jobs they're doing today.

In many applications Namco Solenoids are replacing gear trains, levers, linkages and other complicated mechanisms for automatic operation. And they're giving trouble-free, dependable performance--at a saving in both space and expense. What's more, remote control is no trick—operation is through wires, not pipes or shafts—to any point, however inaccessible.

We've *engineered* Namco Solenoids to operate hydraulic valves, apply brakes, engage clutches, close switches, operate safety devices and do many other similar tasks. But don't think of solenoids as a stock commodity, to be bought off the shelf. Each of these jobs is a specialized problem, calling for a specialized application—with the engineering help of an expert.

Take the push-type solenoid illustrated, for example. In it we've incorporated a leather saddle to cushion the return blow of the plunger. By eliminating the clips or pins commonly used for this purpose we distribute the impact, absorb the shock and cut down noise. The result is the addition of literally millions of contacts to the solenoid's life.

That kind of engineering "know-how" comes *only* from experience. That's why we say, if you haven't yet adapted solenoids to your product, come to *us*. We'll help you engineer the size and style best suited to your job—and the terminal blocks that go with the housing or mounting selected. Like more details? We're ready to serve you.

NAMCO
"STELLITE"-WELDED
SOLENOIDS
THE NATIONAL ACME COMPANY

. . .

Ask for Bulletin giving complete details on Namco "Stellite-Welded" Solenoids—built-in sizes with ratings from 2½ to 25 pounds, push or pull, 1" stroke. Use the coupon.

ELECTRICAL MANUFACTURING DIVISION

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

The National Acme Co.,
170 East 131st Street,
Cleveland 8, Ohio

Please send Bulletin EM-46.

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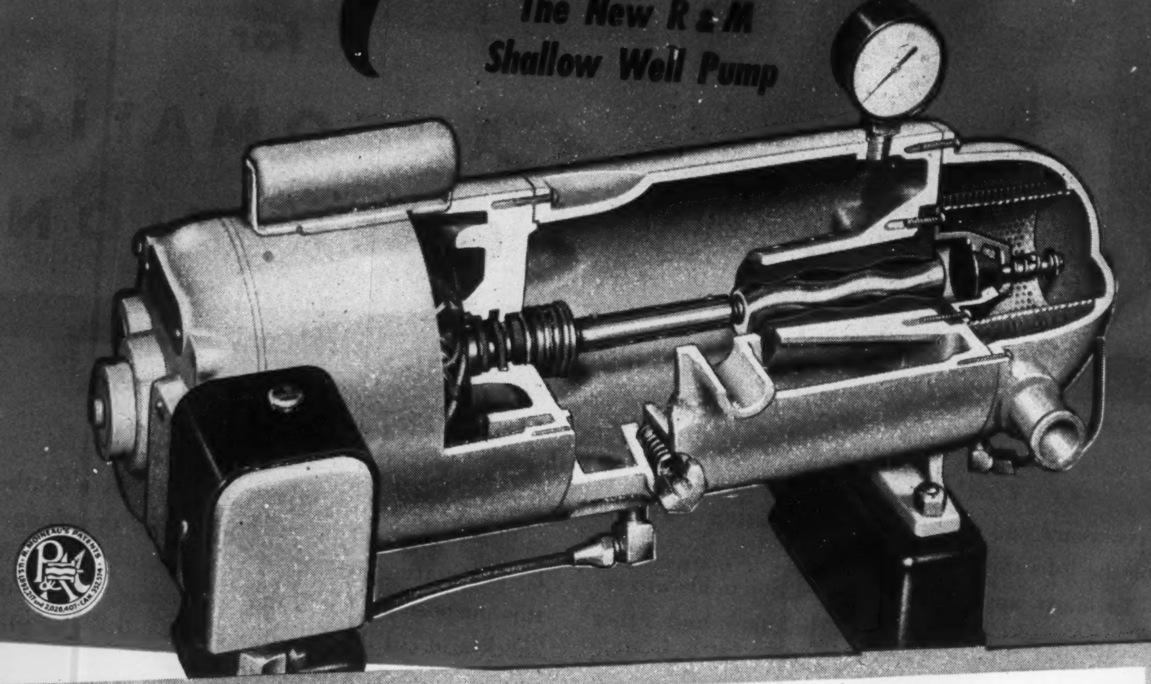
MOYNO WORLD'S MOST VERSATILE PUMP SOLVES ANOTHER PROBLEM

The New R & M Shallow Well Pump



If It Will Push Through a Pipe, the R & M Moyno Will Pump It!

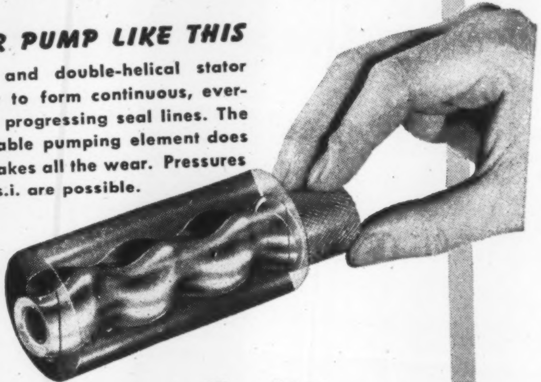
This new R & M Shallow Well Pump introduces another *special-purpose* adaptation of the amazing Moyno rotor-stator pumping principle that is doing such *excellent work* in industry. Quiet, compact, and utterly simple, this new development for shallow wells and cisterns now brings to domestic users the same dependability and *trouble-free long service* that have made the Moyno famous.

MOYNOS DO ALL THIS . . . AND MORE

Moynos have no pistons, valves, or high-speed impellers, yet they deliver positive pressure *without* pulsation—handle virtually anything from liquids to non-pourable pastes. They pass particles and solids in suspension, resist *chemicals and abrasives.* They're reversible; self-priming. And they stand up on "impossible" pumping jobs where *other* pumps have failed. No Moyno body casting has ever worn out.

NO OTHER PUMP LIKE THIS

Helical rotor and double-helical stator work together to form continuous, ever-changing and progressing seal lines. The easily replaceable pumping element does all the work, takes all the wear. Pressures up to 1000 p.s.i. are possible.



Free Illustrated Booklet

Standard types and sizes serve every usual industrial purpose—general service, higher pressures, volatiles, and edibles. Thousands in daily use. Distributors from coast to coast. If you use pumps or ever expect to, *you* should know about the Moyno. Interesting free booklet, *"A Turn for the Better,"* explains the patented Moyno pumping principle; gives typical industrial applications, dimensions, and pressure and capacity data. Literature on the new Shallow Well Pump also mailed on request.

ROBBINS & MYERS · INC. MOYNO PUMP DIVISION · SPRINGFIELD, OHIO
In Canada: Robbins & Myers Co. of Canada, Ltd., Brantford, Ont.
MOTORS · HOISTS · CRANES · MACHINE DRIVES · FANS · MOYNO PUMPS · FOUNDED 1878

...looking for
better gears?

A thousand pounds of shining steel swinging at one thousand r.p.m.—pulling more than 250,000 pounds of airplane through the air—that's the job of the Curtiss C636S propeller, the largest in service in the world. It is doubtful if any gears are called upon to endure tougher service than these sleek, glistening miracles of perfection that are the heart of this mighty propeller. Naturally, they are "A-Q" (aircraft quality) gears produced in the plants of Foote Bros.

The ability of "A-Q" Gears to perform faithfully under even extremes of service is due:

. . . to the extremely close tolerances to which every dimension is held;

. . . to the unique developments in heat-treating that assure proper hardness and proper strength of every part;

. . . to the extraordinary control of every step in production.

"A-Q" Gears have solved many tough problems where high speed, greater efficiency, compactness, light weight and low noise level are required. They offer a new approach in design to your engineers faced with problems of increased speed or longer life.

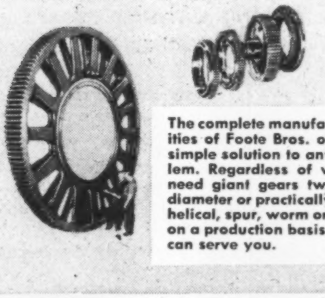
Regardless of your requirements in quality gears, the two large plants of Foote Bros. have the facilities to produce them, backed by nearly a century of experience.

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
Dept. O, 4545 South Western Boulevard, Chicago 9, Illinois

Three bulletins on Foote Bros. products are now available. They are:
(1) "Whatever Your Needs in Gears."
(2) "Aircraft Quality Gears."
(3) "Foote Bros. Power Units."
Write for copies of the bulletins you desire.



The complete manufacturing facilities of Foote Bros. offer a quick, simple solution to any gear problem. Regardless of whether you need giant gears twenty feet in diameter or practically any size of helical, spur, worm or bevel gears on a production basis, Foote Bros. can serve you.

The complete Foote Bros. line includes helical gear and worm gear speed reducers in a wide range of sizes and ratios to meet practically every industrial need. Let our engineers furnish details on the type best suited to your needs.

Foote Bros. Power Units are today solving many problems in controlling linear or rotary motion from a remote point. They may be designed to fit a confined space envelope, will operate on an exact time cycle and offer the advantage of high speed where desired. Consult Foote Bros. engineers.

ALLIS-CHALMERS

Pre-Engineered

ALLIS-CHALMERS
Pre-Engineered
TEXROPE DRIVES
...lt Drive for Every Application!

COMPLETE AUTHORITATIVE PRACTICAL

— ONLY ALLIS-CHALMERS OFFERS YOU THIS ADVANCED ENGINEERING

THIS IS the most complete V-belt drive reference book ever published. It contains:

PRE-ENGINEERED DRIVE TABLES—1 to 150 hp, thumb-indexed for quick reference. Just turn to the page you want — read off the complete drive data.

ENGINEERING TABLES — sheave dimensions — drive selections — general information. Everything carefully arranged and indexed for easy figuring of special drives.

Book contains 144 pages, size 8½ by 11 inches. Thumb index and classified index make it easy to use.

ANNOUNCES

Texrope Drives

..and a NEW Texrope Manual that Makes Selection Easy

THIS MANUAL marks a revolutionary advance in the application of V-belt drives. It enables every user to select, with unerring accuracy, the one *best* drive for any normal requirement. It eliminates guesswork, figuring and chance for error. It assures greatest possible economy and efficiency in the use of Texrope V-belt drive equipment.

SOLVES 90% OF ALL V-BELT DRIVE SELECTION PROBLEMS

Texrope Pre-Engineered stock drives tables have been worked out in a complete range of speeds, for horsepowers from 1 to 150. These tables show, in one place, the correct drive for any requirement. Each is the *one best drive* for the job, as pre-engineered by the finest V-belt engineering staff in the world.

MOST ECONOMICAL, IN BOTH FIRST COST, MAINTENANCE

Every Pre-Engineered drive selection is made up of regular Texrope stock items. No special-order equipment is required. You can't make the mistake of buying a larger, more expensive drive than you really need, or of installing an underpowered drive that will be costly in performance and maintenance. Texrope Pre-Engineered drive selections are the *best* engineered drives — in low first cost — in performance—in reduced maintenance.

THE RESULT OF 22 YEARS OF V-BELT EXPERIENCE

Only Allis-Chalmers has developed a complete Pre-Engineered drive manual. It is more than the work of slide-rules or the rearrangement of old tables. It includes the industry's greatest V-belt drive experience—the knowledge and judgment gained through 22 years of building and studying V-belt drives for every industrial application.

Copies of this new manual have been sent to many Texrope users and dealers. If you have not received one, write for Texbook No. 20P40. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2249

TEXROPE . . Greatest Name in V-Belt Drives

"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationary or motion control.

SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

AC
1847 1947
A CENTURY OF SERVICE
to Industry
THAT MADE
America Great

Good machine design calls for this good piping equipment...CRANE

The best is none too good for such an integral part of your design as the flow control equipment. So protect your design by specifying Crane—the world's most complete source of quality valves, fittings, piping accessories, and pipe.

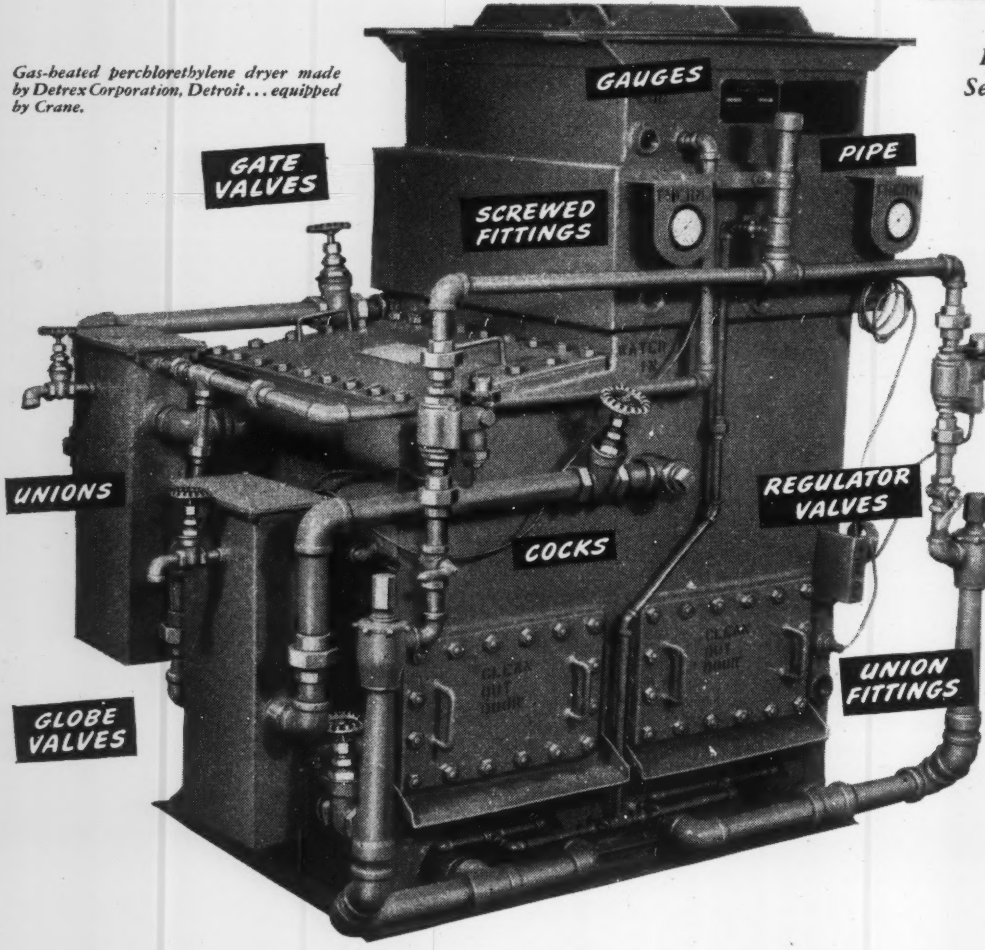
One catalog gives you complete and convenient selection. But that's only your first advantage; putting all responsibility on Crane for piping means simplified buying . . . easier storekeeping. And in your plant, smoother installation of piping equipment is assured.

Naturally, your customers are interested in the piping equipment. When they learn it's Crane, they'll be satisfied—for they, too, know that Crane Quality stands unsurpassed for over 90 years.

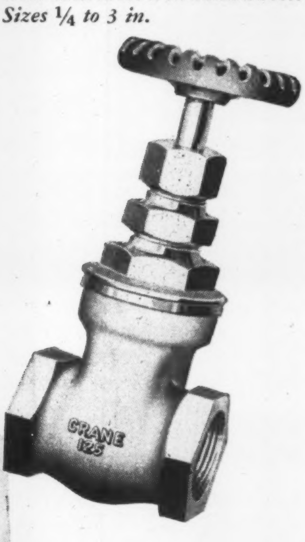
CRANE CO., 836 S. Michigan Ave.
Chicago 5, Illinois
Branches and Wholesalers
Serving All Industrial Areas

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

Gas-heated perchlorethylene dryer made by Detrex Corporation, Detroit... equipped by Crane.



(Below) **SEE PAGE 16** *of your Crane Catalog for standard brass gate valves with higher than usual factor of safety under all service stresses. Where you want extra ruggedness and dependability, Crane No. 438 is your valve. For steam pressures up to 125 pounds; for cold water, oil, gas, up to 200 pounds. Wedge disc; non-rising stem. All brass with malleable iron handwheel. Sizes ¼ to 3 in.*

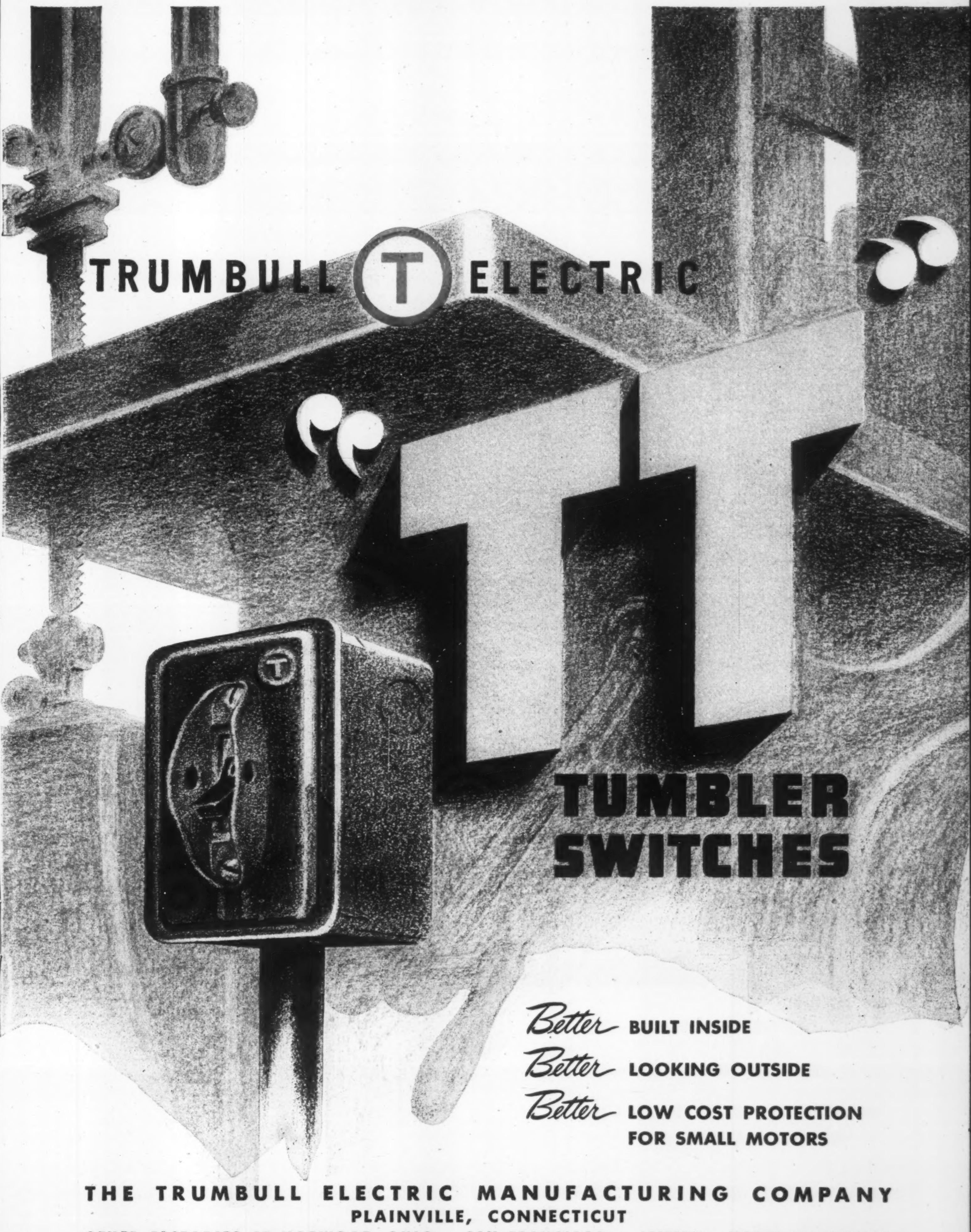


EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM


TRUMBULL T ELECTRIC
"TT"
TUMBLER
SWITCHES

Better BUILT INSIDE
Better LOOKING OUTSIDE
Better LOW COST PROTECTION
FOR SMALL MOTORS

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY
PLAINVILLE, CONNECTICUT
OTHER FACTORIES AT NORWOOD, OHIO • SAN FRANCISCO • SEATTLE • NORTH HOLLYWOOD

What can BURKE do for Me?
BURKE POLYPHASE
1 to 1500 H.P. INDUCTION MOTORS
BURKE ELECTRIC COMPANY, ERIE, PA.
BURKE A.C. GENERATORS
MEDIUM AND HIGH SPEED
BURKE ELECTRIC CO., ERIE, PA.
BURKE
DIRECT CURRENT Generators
ENGINE TYPE · DIRECT DRIVE · BELT DRIVE
BURKE ELECTRIC COMPANY · ERIE, PA.
BURKE
A. C. SYNCHRONOUS GENERATORS for Diesels
BURKE ELECTRIC COMPANY · ERIE, PENNSYLVANIA
BURKE HIGH CYCLE MOTOR GENERATOR SETS
BURKE ELECTRIC CO., ERIE, PA.
OFFICES IN PRINCIPAL CITIES
BURKE
A. C. SYNCHRONOUS MOTORS for Compressors
BURKE ELECTRIC COMPANY · ERIE, PENNSYLVANIA
BURKE TERMINAL BLOCKS
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BURKE ELECTRIC COMPANY ERIE PENNSYLVANIA
BURKE D. C. MOTORS
BURKE D. C. GENERATORS
BURKE MOTOR GENERATOR SETS

Burke is now in production on an improved line of cool running drip-proof induction motors which are fully standardized, in NEMA frame sizes 203 to 505. Cooling air enters at both ends, below centerline over the sealed bearings and is baffled to scrub the entire interior of the motor and is discharged at each side below the centerline. These are the coolest running induction motors that we have built in 41 years, and incorporate a 30 year experience with welded steel plate frame construction. Write for bulletin D-1.

⇨ ⇨ For quick reference to the Burke line, see Sweet's Catalog File and Electrical Buyers' Reference Catalog.

BURKE ELECTRIC COMPANY 19710 WEST 12TH STREET ERIE, PENNSYLVANIA

D. C. Equipment to 1500 H. P and 1000 K. W.
A. C. Equipment to 1500 H. P and 1000 K. W.
M-G Sets to 1000 K. W.
Molded Bakelite Terminal Blocks

This is a LEATHER PACKING

Like all Sirvis packings it was engineered from the unblemished center portion of the finest steer hides. Selected, treated and molded under strict laboratory control, Sirvis packings can be used to seal oil, water, air or other fluids and gases under various pressures and temperatures. Correct in design, tannage, and degree of hardness or flexibility, they will give long, rugged service. For maximum assurance of such accuracy, dependability and perfect performance, when you need leather packings, always order *Sirvis*.

sirvis

MECHANICAL LEATHERS

Products of

CHICAGO RAWHIDE MANUFACTURING CO.

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New York • Philadelphia • Detroit • Los Angeles • Cleveland • Boston
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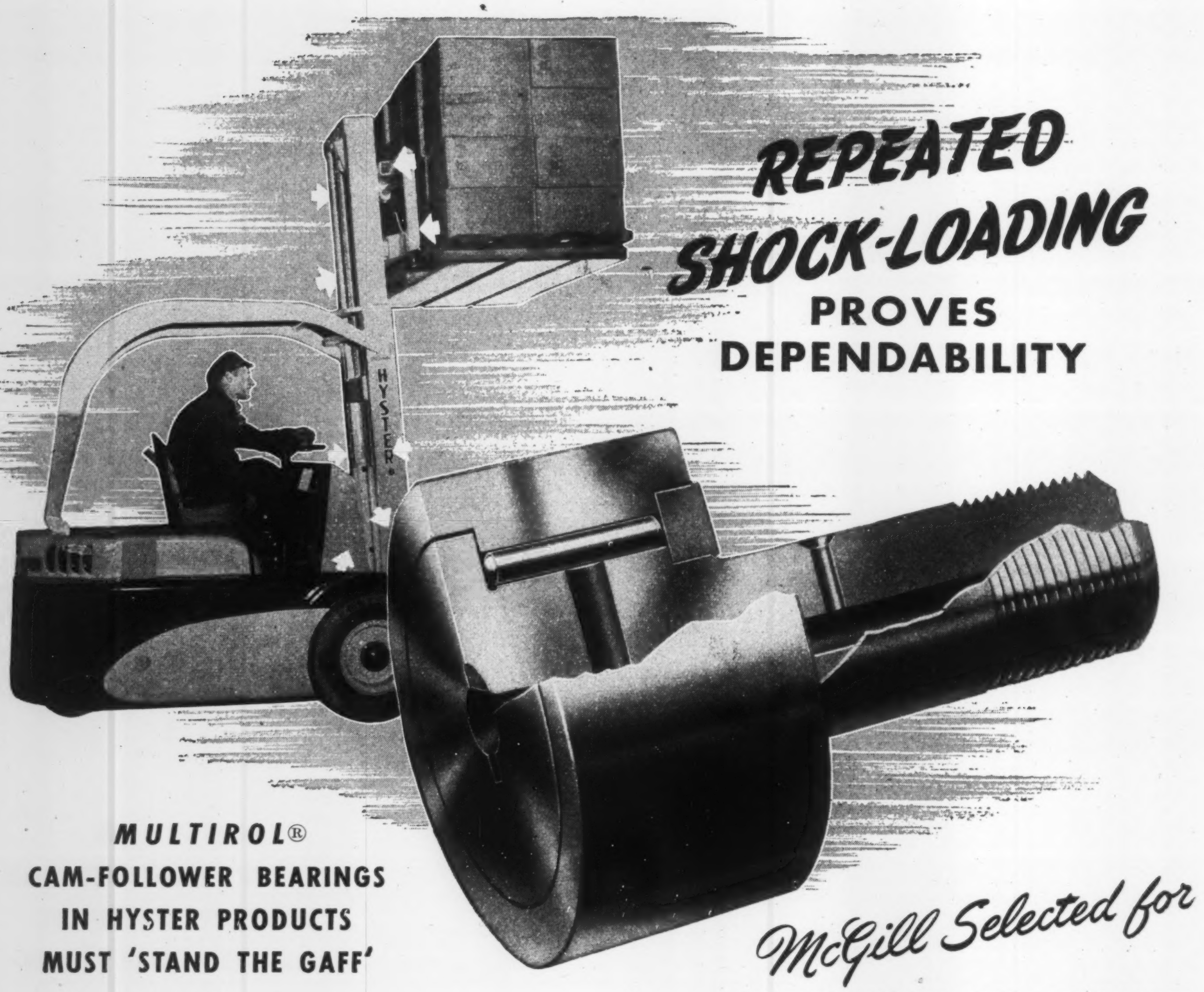


REPEATED SHOCK-LOADING PROVES DEPENDABILITY

MULTIROL®
CAM-FOLLOWER BEARINGS
IN HYSTER PRODUCTS
MUST 'STAND THE GAFF'

McGill Selected for

• LONG LIFE • SMOOTH ACTION • DEPENDABILITY

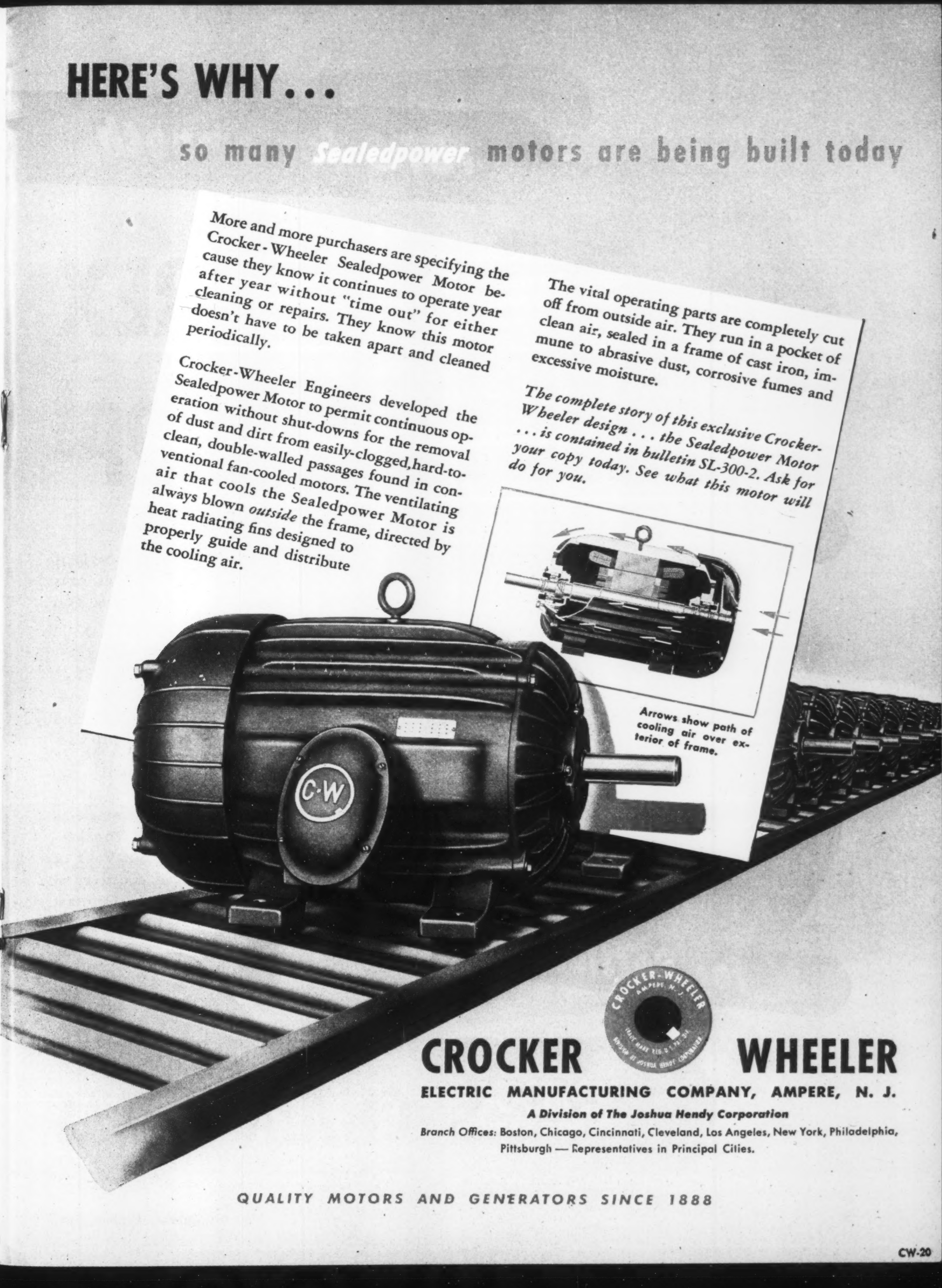
Eight McGILL *MULTIROL* CAM FOLLOWER BEARINGS are used in the Number 40 Hyster Lift Truck made by the Hyster Company, Portland, Oregon. Four of these are located in the load-on apron assembly and four in the hoisting mechanism.

The four thousand pound loads that these trucks carry ride smoothly on free-rolling *MULTIROL* CAM FOLLOWER BEARINGS. Extra heavy race sections, specially heat treated, give an extra margin of load carrying capacity that withstands repeated and severe shock loading conditions. In many applications the Hyster trucks are driven three shifts, 24 hours daily, and as the manufacturer states, the most important feature is the long-life.

McGill Bearings are also used in other Hyster Lift Trucks such as the Number 20 and in other Hyster products including the D7N Towing Winch and A-frame Arch . . . all of which must carry heavy loads and operate smoothly and dependably.

For complete MULTIROL CAM-FOLLOWER information write today for Bulletin CF-40A:
McGill Manufacturing Company, Inc.,
200 N. Lafayette Street, Valparaiso, Indiana.

McGILL
precision bearings



HERE'S WHY...

so many *Sealedpower* motors are being built today

More and more purchasers are specifying the Crocker-Wheeler Sealedpower Motor because they know it continues to operate year after year without "time out" for either cleaning or repairs. They know this motor doesn't have to be taken apart and cleaned periodically.

Crocker-Wheeler Engineers developed the Sealedpower Motor to permit continuous operation without shut-downs for the removal of dust and dirt from easily-clogged, hard-to-clean, double-walled passages found in conventional fan-cooled motors. The ventilating air that cools the Sealedpower Motor is always blown *outside* the frame, directed by heat radiating fins designed to properly guide and distribute the cooling air.

The vital operating parts are completely cut off from outside air. They run in a pocket of clean air, sealed in a frame of cast iron, immune to abrasive dust, corrosive fumes and excessive moisture.

The complete story of this exclusive Crocker-Wheeler design . . . the Sealedpower Motor . . . is contained in bulletin SL-300-2. Ask for your copy today. See what this motor will do for you.

Arrows show path of cooling air over exterior of frame.

CROCKER WHEELER

ELECTRIC MANUFACTURING COMPANY, AMPERE, N. J.

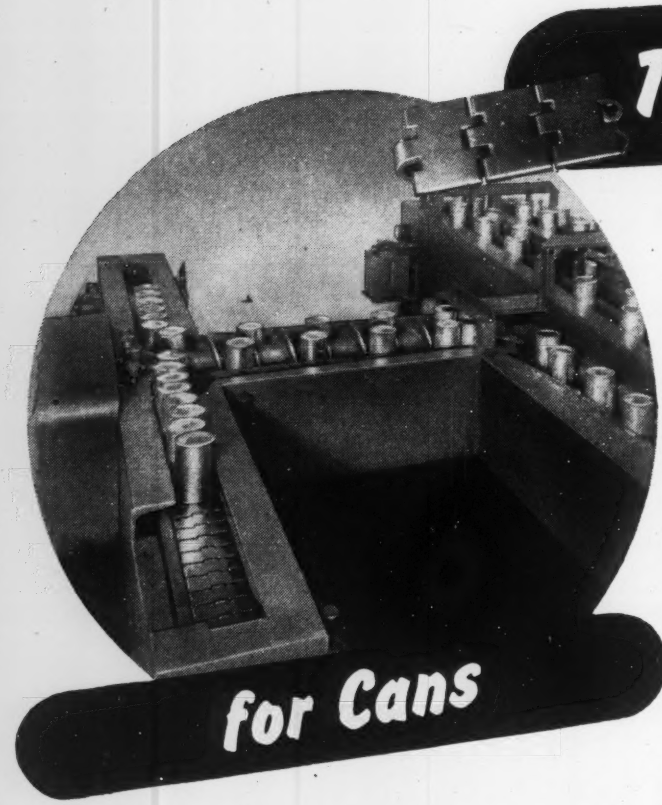
A Division of The Joshua Hendy Corporation

Branch Offices: Boston, Chicago, Cincinnati, Cleveland, Los Angeles, New York, Philadelphia, Pittsburgh — Representatives in Principal Cities.

QUALITY MOTORS AND GENERATORS SINCE 1888

TOPS for smooth,

REX Table Top!



for Bottles

● Whether your machine design problems involve the conveying of jars, bottles, cans or small parts, you'll find Rex Table Top Chain the ideal answer. Here's why!

1. Smooth, Tip-Free Conveying. Only Rex Table Top Conveyor Chain provides a constant carrying surface. There is no gap across the width of the link to catch and trip containers.

2. Simple Design. There are no attachments to loosen or "wobble" with Table Top. Precision-formed, one-piece platform links of all-stainless or case-hardened construction are connected by husky rivets. Contrast this simple design with ordinary flat-top chain.

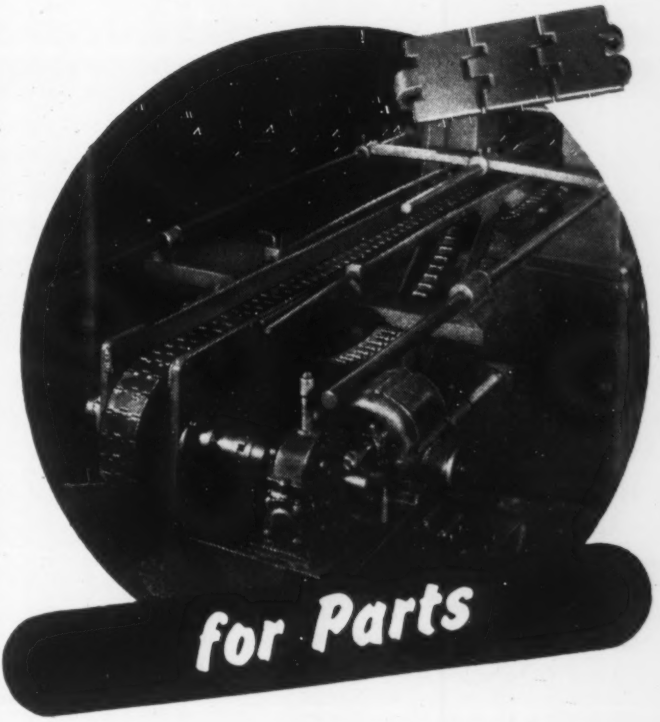
REX CHAIN BELTS

steady conveying....

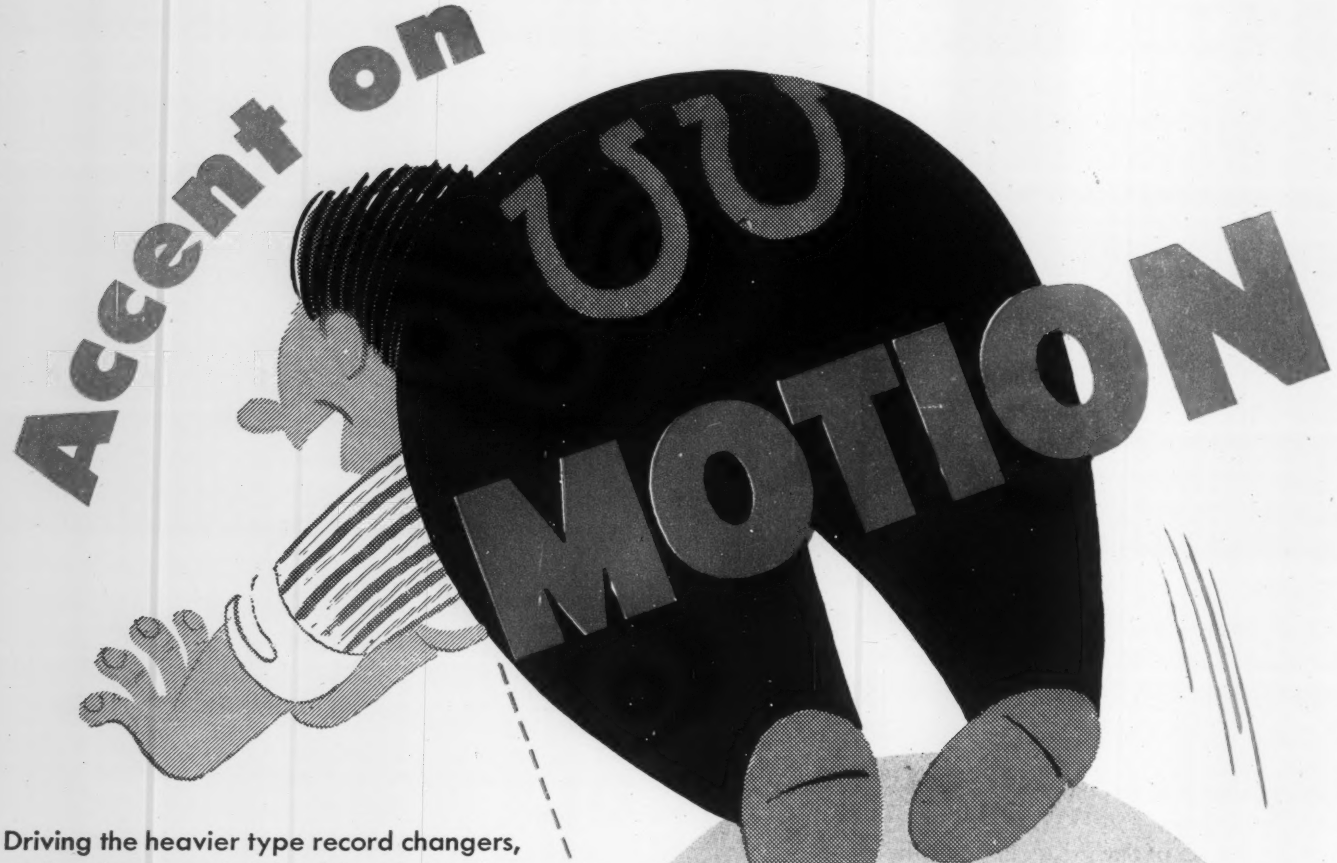
3. Long Service Life. With Table Top, the entire link absorbs the pulling load. Sprocket tooth bearing pressure is spread over the entire length of the joint . . . not concentrated on a small area. Table Top just has to last longer.

4. Stays Cleaner . . . and is easy to clean. There are no pockets on Table Top to catch and hold foreign matter. It can be easily cleaned when necessary with a jet of water or steam.

The Rex Man will be glad to assist you in the application of Table Top to your designs. For all the facts and for engineering assistance, call him or write direct to Chain Belt Company, 1643 West Bruce Street, Milwaukee 4, Wis.



CHAIN BELT COMPANY
of Milwaukee . . . . .



Driving the heavier type record changers, radio phonograph turntables and tuning devices—powering fans, motion displays, actuating switches, levers and timing devices—operating business and vending machines, toys—these are just a few of the tasks performed by *Alliance's Model K Powr-Pakt motor.*

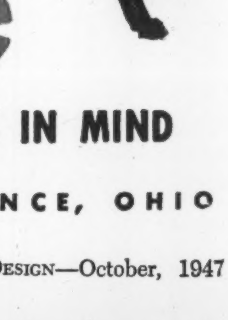
This basic 2-pole induction type motor can be *mass produced* to meet variations in design. It will adapt to any standard AC voltage and frequency, and will develop up to 1/100th h. p. For intermittent duty or where forced ventilation is provided even greater output can be obtained. Model K is used in all 25-cycle and in some 50 and 60-cycle Alliance phonomotors.

The trend is to make things move!

Designs will call for more action—movement! Flexible product performance needs power sources which are compact, light weight! Alliance Powr-Pakt Motors rated from less than 1-400th on up to 1-20th h. p. will fit those "point-of-action" places! Alliance Motors are *mass produced at low cost*—engineered for small load jobs!

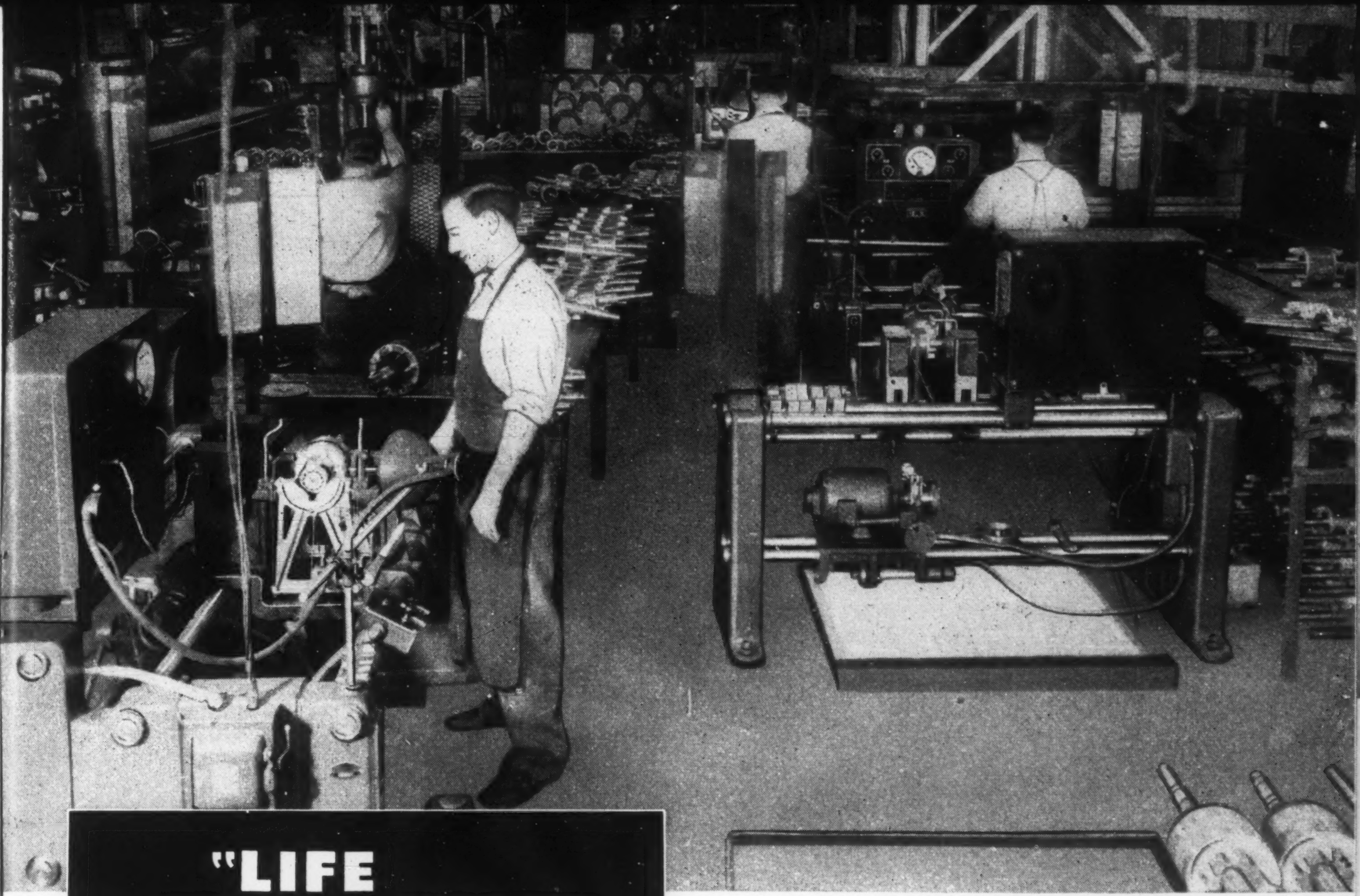
For vital component power links to actuate controls... to make things move... plan to use them!

MODEL K



WHEN YOU DESIGN—KEEP alliance MOTORS IN MIND

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO



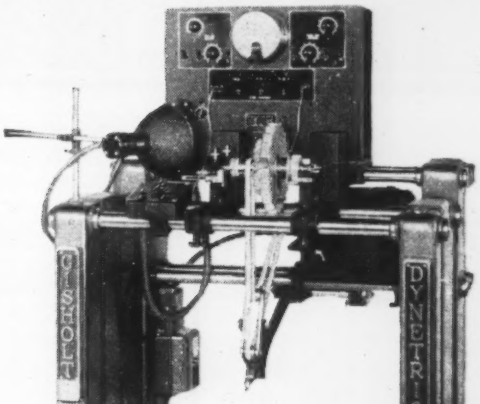
"LIFE INSURANCE"

for electric motors

Gisholt DYNETRIC* Balancing Machines† increase the life expectancy of electric motors by eliminating the most common cause of failure—*vibration.*

But they do more than that—they insure smoother, more efficient performance. No matter what the job may be, they do a better job. That's important—not only from the user's standpoint but from the manufacturer's as well.

Balancing Departments, like that pictured above, handle this work quickly and economically when they are equipped with Gisholt DYNETRIC Balancing Machines. They put balancing on a mass production basis. And they provide a degree of accuracy which cannot be equaled by any other means.



GISHOLT DYNETRIC TYPE S BALANCER—*one of many sizes and types available to handle parts from a fraction of an ounce up to many tons. Locating and measuring unbalance requires but a matter of seconds. Where practical, correction equipment can be included as a part of the machine. Write for complete details.*

GISHOLT MACHINE COMPANY

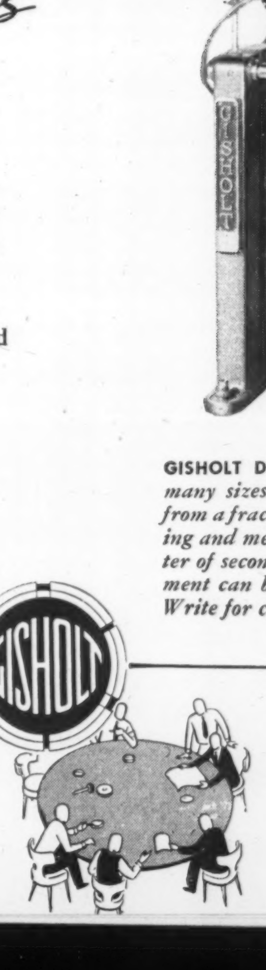
Madison 3, Wisconsin

**DYNETRIC is a Trade-mark Reg. U. S. Pat. Off. by Westinghouse Electric Corporation.*

†Developed jointly with Westinghouse Electric Corporation.

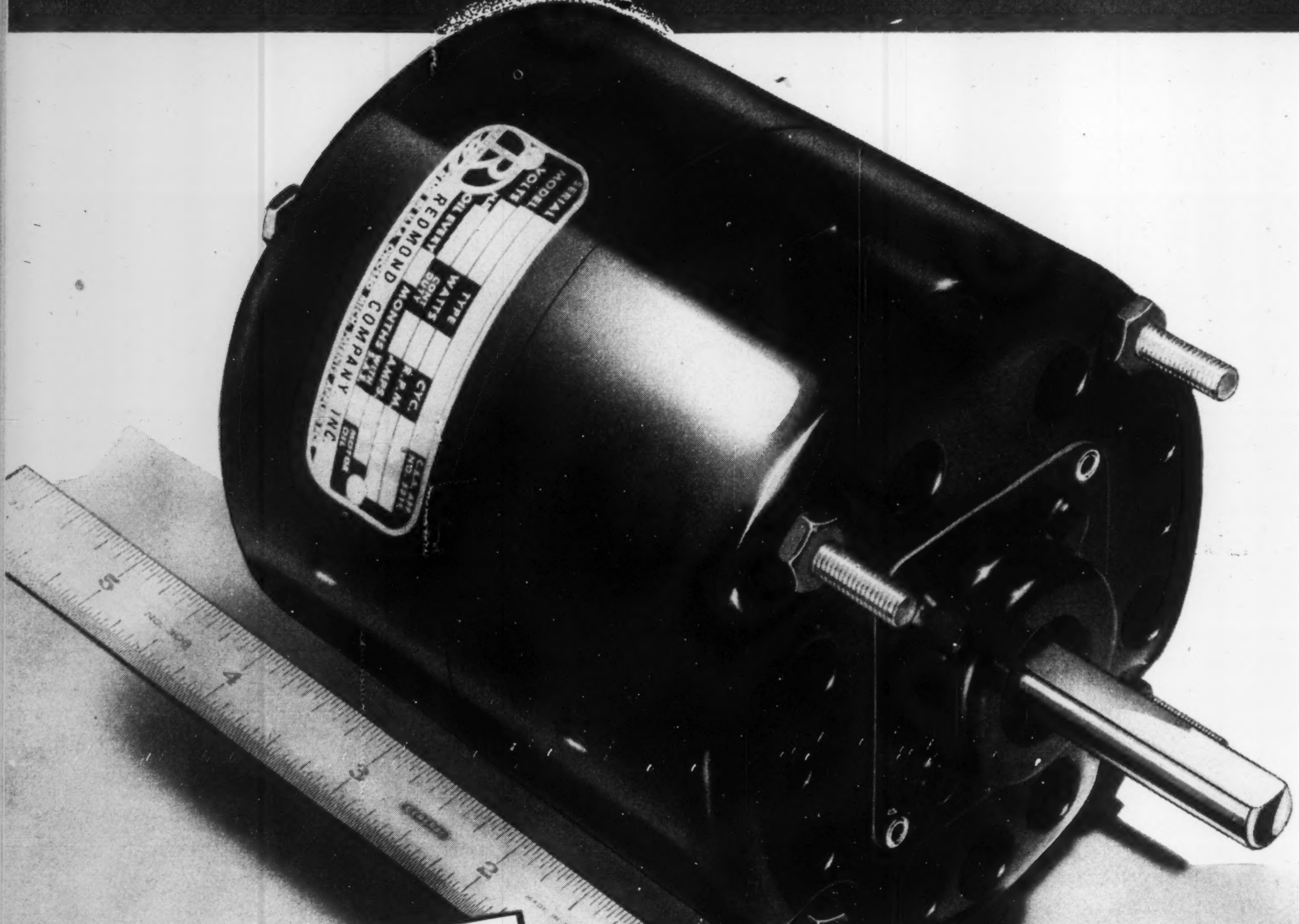
GISHOLT

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly-round parts. Your problems are welcomed here.*

NEW *Low Cost*

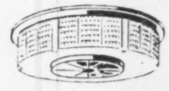

SERIAL
MODEL
VOLTS
TYPE
WATTS
CYC
R.P.M.
AMPS
OIL LEVEL
REDMOND COMPANY INC.

Built by SPECIALISTS

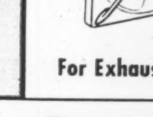
You can expect and will receive complete cooperation on your motor problems at Redmond Company, Inc. Here is an organization of specialists, who manufacture Micro-motors, speed controllers and small blower units, exclusively—no complete consumer products to compete with the products of customers.

For Air Circulators

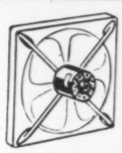
For Window Type Ventilators



For Unit Coolers



For Evaporative Coolers



For Exhaust Fans

1/15th Horsepower

·hita City Lib·

TYPE
"W"
A.C.

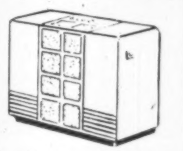
Redmond

MICROMOTOR

THIS NEW high quality, low cost, 4-pole shaded pole, fan duty A.C. Micromotor, built in sizes up to 1/15th horsepower, is non-radio interfering and packed with long-life features, trouble-free operation and smooth performance.

It has individually fitted bearings, broadly spaced to provide solid footing for thousands of hours of operation. Extra-capacity lubrication circulates through porous bearings to retard gumming and assure a film of lubricant over the two square inches of bearing surfaces.

For Pedestal Fans



For Air Conditioners

The heart of the Type "W" is the famous Redmond patented Flush-Weld precision skewed, micro-balanced rotor. Here's maximum electrical conductivity, and quiet operation. In this rotor there are no slots to collect chips, dirt and dust.

Windings are of the finest coated type, heavily impregnated with varnish for maximum resistance to humidity and oil. Laminations are of top quality electric steel held to rigid specifications for precision electrical characteristics.

Drop us a line now and get the details. Get acquainted with the extra *free* services offered by Redmond, such as the *Redmond Styling Service* and *Redmond Customer Engineering Service.*

Expanded facilities. Prompt deliveries. Service before and beyond the sale.

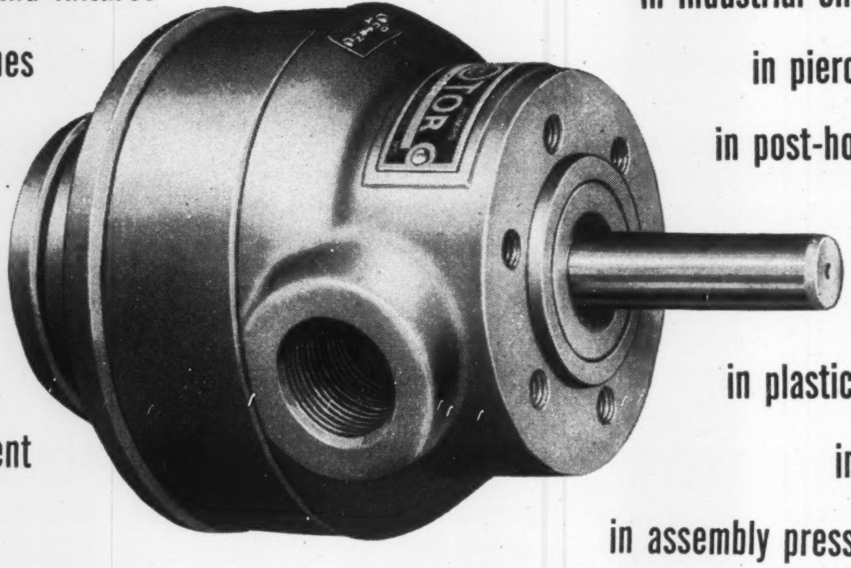
Redmond COMPANY, INC.

***Main Office:* OWOSSO, MICHIGAN, U.S.A.**

Redmond facilities now total more than 5 acres floor area and 3000 employees.

PERFORMANCE *
is the pay-off!

in machine tools and fixtures
in die-casting machines
in elevators
in punch presses
in baling presses
in clamping fixtures
in testing equipment
in steering devices
in straightening presses
in material-handling equipment



in industrial oil burners
in piercing presses
in post-hole diggers
in plastic presses
in conveyors
in assembly presses

GEROTOR
hydraulic pumps

* Pressures up to 1200 p.s.i. continuous, 1500 intermittent. Deliveries from .4 to 40 g.p.m.

GEROTOR MAY CORPORATION • BALTIMORE 3, MARYLAND

"TRULY LIFE-TIME MOTORS"
B-LINE
Reg. Trade Mark
Superlative Horse Power
1/6 TO 30 HP

Inquiry is invited from manufacturers of motor-driven equipment or quantity users of Motors and Gearmotors . . . Added plant facilities enable us to offer advantages in service and delivery to those interested in quality products. Wire or write for Bulletin No. 5000.

THE BROWN-BROCKMEYER COMPANY

PLANTS AT DAYTON, WILMINGTON, WASHINGTON AND XENIA, OHIO

GENERAL OFFICES, DAYTON 1, OHIO

District Offices in Principal Cities

116% MORE POWER PER POUND . . .

Up to 134% more starting torque per pound of motor . . . with as much as 116% more maximum torque per pound! As much as one third smaller . . . yet stronger mechanically AND electrically than any previous Westinghouse induction motor!

That's the achievement represented in the Westinghouse Life-Line—the biggest single advance in fundamental motor design in 58 years.

It wraps up in one solid steel-encased package, user preferences formerly obtainable only as custom-built features, if at all.

It makes available to industry, in a standard line of motors, improvements perfected for special wartime requirements.

Life-Line Motors are now in production at the new Buffalo Westinghouse Motor Plant, in frame sizes representing the popular demand of induction motor ratings. Check your nearest Westinghouse office for availability, or write Westinghouse Electric Corporation, P. O. Box 2025, Buffalo 5, N. Y.

J-21408

WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Life-Line motors

up to ⅓ less space!

Features and improvements demanded most by users—

ALL-STEEL PROTECTION

All frames, feet and brackets are HEAVY STEEL. Stators are far stronger... new core locking device eliminates rivets.

NO LUBRICATION FOR 5 YEARS

No greasing is needed for AT LEAST FIVE YEARS. Bearings are pre-lubricated... sealed against dirt and moisture.

NEW QUIET SMOOTHNESS

Life-Lines cut vibration and noise to new low limits for standard motors... satisfy many "special motor" needs.

LESS SPACE PER HP

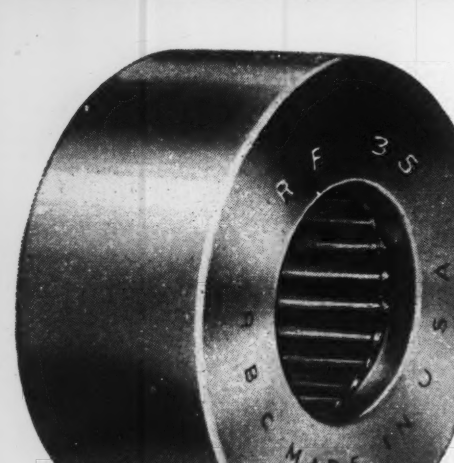
Life-Line Motors occupy less space per hp than any other standard motor... are easier to build into machines and install in cramped quarters.

IMPROVED WINDINGS

New insulating materials... coil winding techniques... stator slot designs... give new record-setting protection against electrical failures.

NEW SLEEK LINES

The Life-Line has sleek lines... a smooth finish... discourages dust and dirt accumulations... harmonizes with modern machine and tool design.

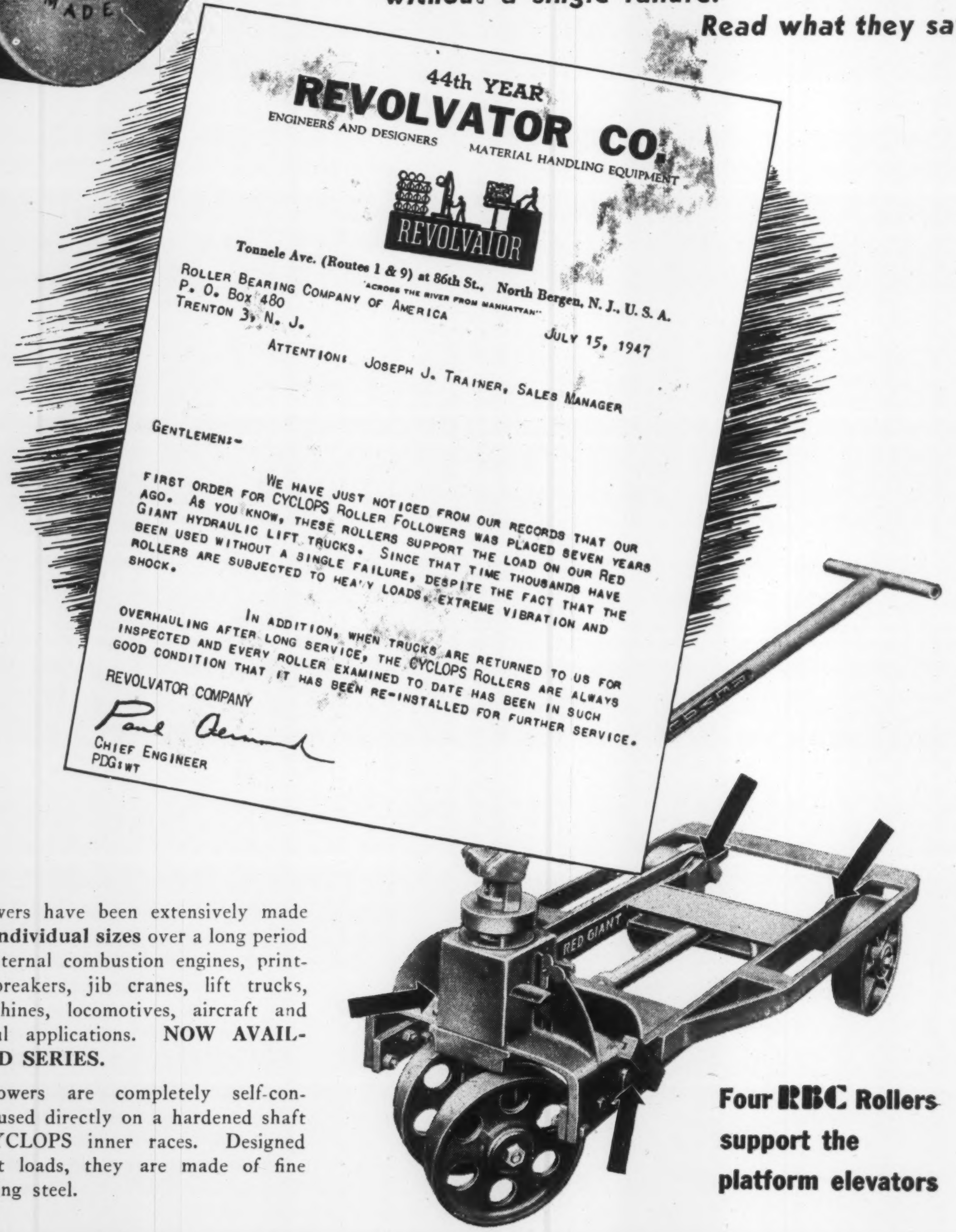


You, too, Can Expect Such Service!

RBC CYCLOPS SERIES HEAVY WALL ROLLER FOLLOWERS

used for seven years in REVOLVATOR COMPANY'S "Red Giant" hydraulic "LIFTRUCK" without a single failure!

Read what they say.



44th YEAR
REVOLVATOR CO.
ENGINEERS AND DESIGNERS
MATERIAL HANDLING EQUIPMENT
REVOLVATOR
Tonnele Ave. (Routes 1 & 9) at 86th St., North Bergen, N. J., U. S. A.
ACROSS THE RIVER FROM MANHATTAN

ROLLER BEARING COMPANY OF AMERICA
P. O. BOX 480
TRENTON 3, N. J.

JULY 15, 1947

ATTENTION: JOSEPH J. TRAINER, SALES MANAGER

GENTLEMEN:-

WE HAVE JUST NOTICED FROM OUR RECORDS THAT OUR FIRST ORDER FOR CYCLOPS ROLLER FOLLOWERS WAS PLACED SEVEN YEARS AGO. AS YOU KNOW, THESE ROLLERS SUPPORT THE LOAD ON OUR RED GIANT HYDRAULIC LIFT TRUCKS. SINCE THAT TIME THOUSANDS HAVE BEEN USED WITHOUT A SINGLE FAILURE, DESPITE THE FACT THAT THE ROLLERS ARE SUBJECTED TO HEAVY LOADS, EXTREME VIBRATION AND SHOCK.

IN ADDITION, WHEN TRUCKS ARE RETURNED TO US FOR OVERHAULING AFTER LONG SERVICE, THE CYCLOPS ROLLERS ARE ALWAYS INSPECTED AND EVERY ROLLER EXAMINED TO DATE HAS BEEN IN SUCH GOOD CONDITION THAT IT HAS BEEN RE-INSTALLED FOR FURTHER SERVICE.

REVOLVATOR COMPANY

Paul Aeund

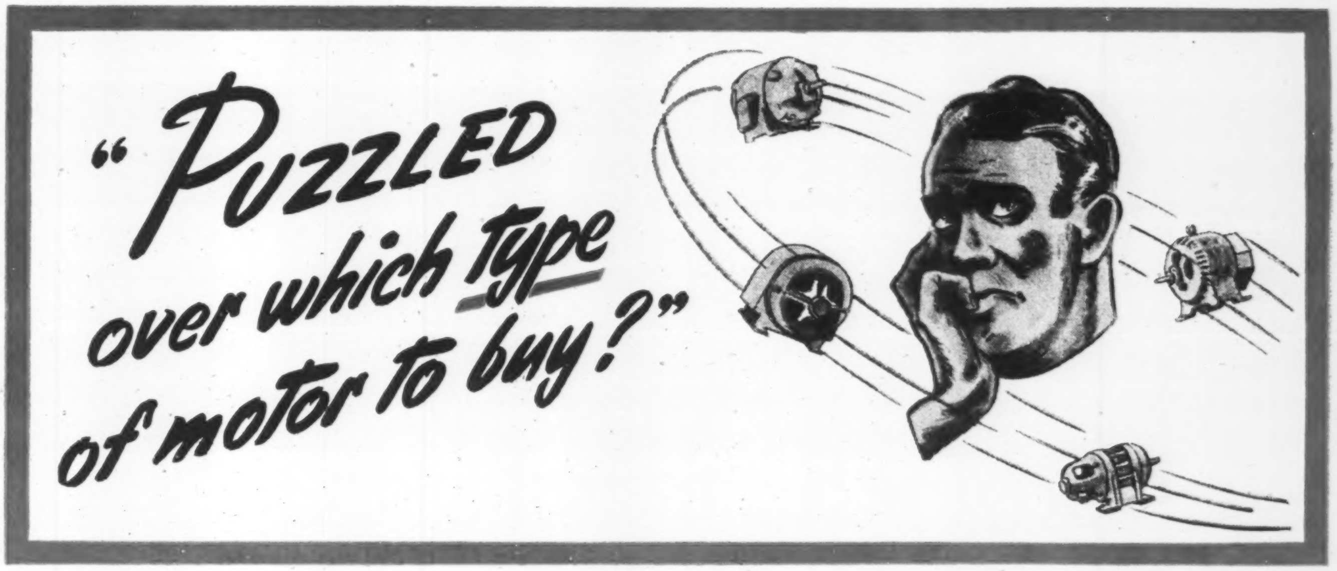
CHIEF ENGINEER
PDG:WT

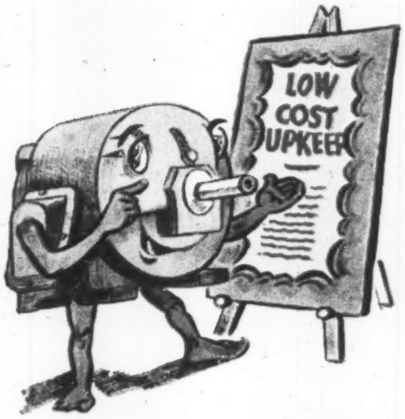
Four RBC Rollers support the platform elevators

These Roller Followers have been extensively made on **special orders in individual sizes** over a long period of years for use in internal combustion engines, printing presses, circuit breakers, jib cranes, lift trucks, automatic screw machines, locomotives, aircraft and many other successful applications. **NOW AVAILABLE IN STANDARD SERIES.**

These Roller Followers are completely self-contained. They can be used directly on a hardened shaft or with standard CYCLOPS inner races. Designed to take heavy impact loads, they are made of fine alloy carburizing bearing steel.

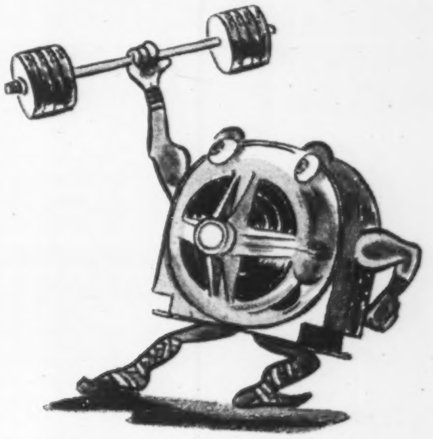
ROLLER BEARING CO. OF AMERICA
TRENTON, NEW JERSEY


"Puzzled over which type of motor to buy?"



In 80% of the Cases, open squirrel-cage induction motors meet the need. They fit most drives, and can be obtained in numerous standard and special designs to meet varying conditions of starting torque, slip, etc. They are also the most economical type to buy and to maintain. Allis-Chalmers builds induction motors in sizes from ½ to 10,000 hp — or higher, if needed.

For Tough Starting Conditions, wound-rotor induction motors are recommended. Their high starting torque, at comparatively low starting current, and their controllable speed characteristics are desirable in drives for conveyors, grinding mills and other tough starting assignments. Compact, accessible Allis-Chalmers wound rotor induction motors range in size from 5 to 10,000 hp.



For Slow Speed, direct-connected drives as low as 75 rpm, or other constant speed applications at higher rpm, synchronous motors are a good solution. They are of particular benefit when a system's power factor is low, since they can be furnished for operation at either unity or leading power factor. From 40 hp to 50,000 hp and higher — in bracket bearing, pedestal bearing, or engine types.

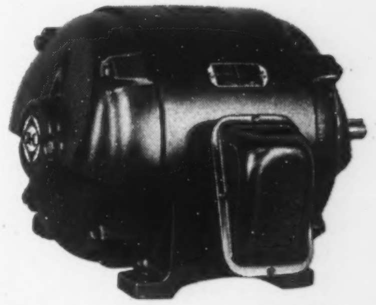
D-C CURRENT ONLY

Is d-c Available? Then adjustable speed operation is easily obtainable. Allis-Chalmers builds d-c motors from ½ to 10,000 hp and higher — for constant or adjustable speed duty in ranges of 6:1 and lower. By means of a source of d-c voltage, adjustable speed motors may also be designed to operate over a speed range as high as 30:1. Suitable for fans, elevators, etc.

Select from the Complete Allis-Chalmers Line!

NOT JUST FOLLOWING popular choice and using a standard squirrel cage induction motor. But the *right* motor for economy and efficiency.

That means an overall knowledge of *all* types of motors . . . their operation . . . limitations . . . maintenance. And there's where your A-C representative can be a big help. His recommendations are backed by experience . . . and the Allis-Chalmers motor he selects is *itself* backed by 50 years of experience in motor design and building. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2304



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One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products

Topics

METAL SO SOFT that it melts in hot water has been put to work by Ford Motor Co. research engineers as a die material for making experimental parts. An alloy of bismuth, tin and lead, the metal is ordinarily too soft to withstand the pressures imposed on dies. This obstacle has been overcome by freezing the die in liquid nitrogen. Developing a hardness greater than brass, the dies produce from six to ten stampings between chillings.

ELECTROPLATED ROD ¼-inch in diameter may be cold drawn down to diameters as fine as 0.0038-inch in a new process developed by Kenmore Metals Corp. Included are nickel-plated steel wire and nickel or silver-plated copper wire.

JET-PROPELLED Banshee, developed by McDonnell Aircraft Corp. and known as the most powerful single-seat fighting plane in the U. S., is in the 600 mile-an-hour class and can climb at the rate of 9000 feet a minute.

PLASTIC MATCHPLATES, cope and drag equipment, and master pattern duplicates are being used by many foundries with a high degree of success according to Plastics Corp. of Chicago. Among the advantages are long wearing qualities, high surface smoothness without "ram-off" of sand, unusual strength, sand-abrasion resistance, light weight, and moderate cost.

INDUCTION MELTING furnace that permits continuous pouring of aluminum has been developed by Fisher Furnace Division of Lindberg Engineering Co. Two chambers, one of which is for charging and the other for pouring, are connected by a series of straight line melting channels.

CUTTING OF HARD METAL such as carbides by means of the electro-erosion process has been investigated by the Gorki Automobile Works, Russia. A spark discharge is produced in a d-c circuit by breaking the current between the poles, thus removing particles from the anode surface, carrying them over to the cathode in an electrolytic fluid as a medium. Cutting disk is mild carbon steel, 0.5 to 2.5 mm thick and 150 to 350 mm diameter.

METALLIC SHEATHING on the faces of a grinding wheel tends to dissipate heat generated at the arc of contact over the entire area of the wheel. Announced by the Chicago Wheel and Manufacturing Co., the wheel is of the vitrified or ceramic-bond type, cutting faster and cooler with greater life between dressings.

OUTPUT of 175,000,000 pounds of aluminum has been achieved in the first twelve months of operation of The Permanente Metals Corp. The company is entering into the aluminum building materials and pig and ingot fields.

SANDWICH MATERIAL for paneling utilizes two sheets of aluminum separated by aluminum-foil honeycomb core cemented to the sheets. Being developed by The Glenn L. Martin Co., the material has high strength, light weight and other advantages not contained in the original honeycomb material with plastic-impregnated cloth or kraft paper core.

CHEMICAL POLISHING of aluminum embodies no electrical current and is capable of producing specular finishes and highly reflective diffused finishes. Developed by the Colonial Alloys Co., the process involves a 10 to 60 second immersion in a hot acidic solution, followed by rinses in chemical baths.

WATER DISPLACING LIQUID, called Hydrex, sheds water from the surfaces of metals. Developed by Enthone Inc., it has high penetrating power to enable it to displace water from blind holes and crevices. After the water has been displaced the work is removed from the liquid and the solvent evaporates, leaving a water-free surface with some rust inhibiting properties.

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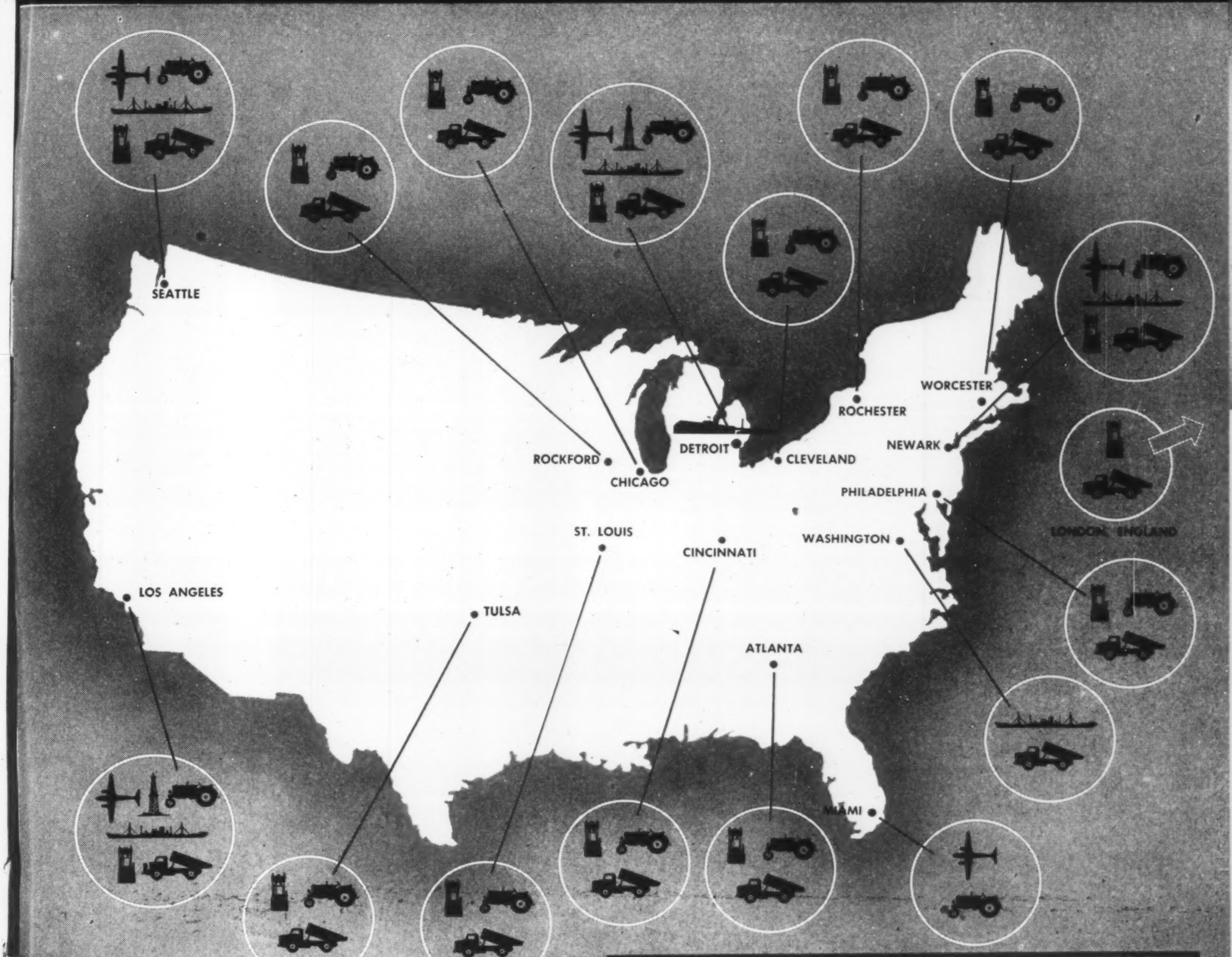
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As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

Calcimine can't slow up SPEEDAIRE

DUST accumulates quickly on everything in this New Jersey Calcimine plant, but it does not impair Speedaire's capacity or efficiency. Speedaire was selected for this job, over a conventional worm gear drive, first, because Speedaire's powerful fan keeps the internal surfaces clean and cool, and second because of the saving in space, weight and cost. The money saved was $117.00.

Speedaire is Cleveland's new fan-cooled worm-gear speed reducer. Because it is fan-cooled, Speedaire will do more work—will deliver up to *double the horsepower* of standard worm units of equal frame size, at usual motor speeds. It can be installed economically on many applications where other types have been used heretofore—giving you the advantage of a compact right-angle drive. Speedaire gives the same long, trouble-free service characteristic of all Clevelands.

For full description, send for Catalog 300. The Cleveland Worm & Gear Co., 3265 E. 80th St., Cleveland 4, O.

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CLEVELAND
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Speed Reducers

A-B
Quality
ALLEN BRADLEY CO.
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OFF
TO RESET
Wait 2 minutes, then move handle to "OFF".
Made in U.S.A.

New Design

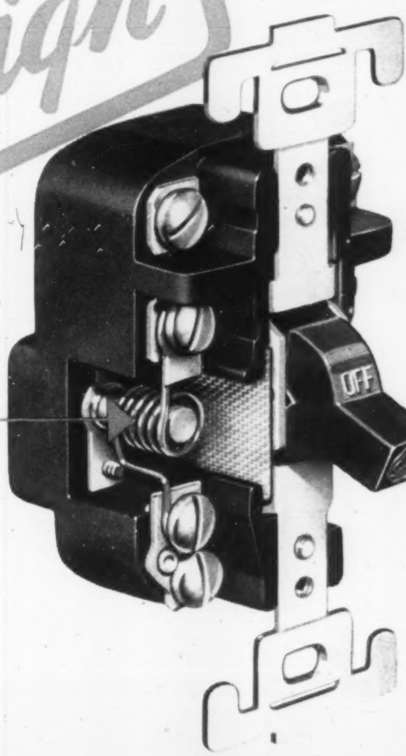
A SMART-LOOKING STARTING SWITCH

for Motors of One Horsepower or Less

This popular manual starting switch has been redesigned . . . inside and out. Its attractive plastic enclosure harmonizes with the streamlined contours of modern appliances and machines. There is more wiring space . . . more accessible terminals . . . more protection for motor and operator.

Meet 1947 N.E.C. Code requirements with this new Bulletin 600 Switch . . . it is a sales asset to any motorized machine.

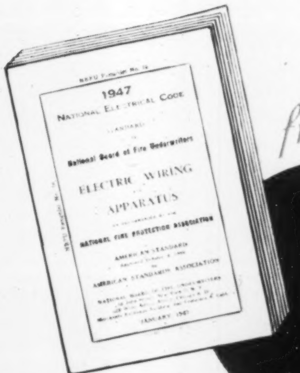
Overload device operates on "soldered ratchet" principle. Impossible to hold switch closed under sustained overload. Easily reset with switch lever after overload is cleared.



Bulletin 600 Starting Switch is a manually operated snap switch with thermal overload device. Essential for most small motor applications. See 1947 N.E.C. Ruling, below.

ARTICLE 4322-C: "ONE HORSEPOWER OR LESS, AUTOMATICALLY STARTED. Any motor of one horsepower or less which is started automatically shall be protected against overcurrent.

from 1947 NATIONAL ELECTRICAL CODE:



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JANUARY 1947

ALLEN-BRADLEY

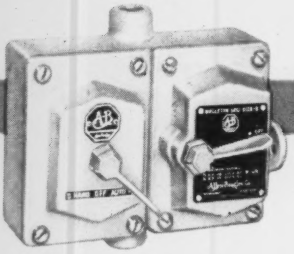
QUALITY

STARTING SWITCHES FOR SMALL MOTORS

See Next Page

BULLETIN 600 Manual Starting Switches for Motors up to One Horsepower

Available in a Wide Variety of Forms and Enclosures

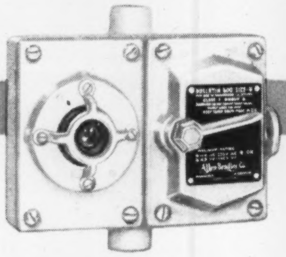


SELECTOR SWITCH

For 3-way "HAND-OFF AUTOMATIC" control. Selector switch on left; Bulletin 600 starting switch on right. Two-way units also available.

SAFETY SEAL

The cast iron enclosure of this Bulletin 600 starting switch has machined seal between cover and base for hazardous gas applications.



PILOT LIGHT

In this form, a red pilot light is combined with Bulletin 600 Switch in cast iron enclosure. For watertight or weatherproof pilot control service.

GENERAL PURPOSE

The plastic enclosure of this Bulletin 600 starting switch is in harmony with the streamlined appearance of the most modern equipment.

These Bulletin 600 Manual Starting Switches show some of the Allen-Bradley switching units extensively used for air-conditioning and refrigeration service.

OVERLOAD PROTECTION—In spite of their extreme compactness they provide accurate and dependable overload protection for motors under one horsepower. Thermal elements for the overload device are available in over three dozen ratings from 0.2 ampere to 12.7 amperes—for accurate overload protection. Meets all N.E.C. code requirements.

NO CONTACT MAINTENANCE—The silver alloy contacts require no cleaning, dressing, or filing, since any oxides that may form are good conductors. Low contact resistance is always assured. Just install these Allen-Bradley starting switches . . . and forget them.

MANUAL SWITCHES FOR MOTORS UP TO FIVE HORSEPOWER

For installations up to 5 hp, 220 v., 7½ hp, 440 v., use Bulletin 609 Manual Starting Switches. Provide accurate overload protection and years of trouble-free operation. Standard enclosures are available for every service.

A-B
Quality
STOP

Bulletin 609 Across-the-line Starters are operated mechanically with START and STOP buttons. Cannot be used for automatic control. For such installations, use Bulletin 709 Magnetic Starters with 2- or 3-wire control.

This cast iron enclosure, with bolted machined covers, is for use in explosive atmospheres. Other standard Allen-Bradley enclosures are available.

Bulletin 609 Manual Starter in flush type pressed steel enclosure is designed for flush mounting in machine housings. Makes attractive installation.

ALLEN-BRADLEY CO. 1316 S. SECOND ST.
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STARTING SWITCHES FOR SMALL MOTORS
QUALITY

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MACHINE DESIGN

Photo, courtesy Westinghouse Electric Corp.

Recent Developments in Metals and Their Processing

By W. F. Craig, Jr.
Supv., Ferrous Metals Research

R A. Lubker
Supv., Nonferrous Metals Research

and W. E. Mahin
Chmn., Metals Research

Armour Research Foundation, Chicago

IMPETUS of engineering developments in metals and metal processing methods during recent years necessitates a general appraisal of these fields at fairly frequent intervals. Although these subjects are too broad to permit detailed treatment of all phases in an article such as this, a general, overall evaluation, touching upon development highlights which open wider fields of application for the engineer and machine designer, should serve a useful and worthwhile purpose.

Periods of intense and broadened production, such as during the past few years, invariably result in new and unusual applications of both the familiar and the recently developed engineering materials. The various methods by

Fig. 1—Above—Pouring molten steel into molds. Use of castings is no longer decreasing owing to vast improvements in foundry methods

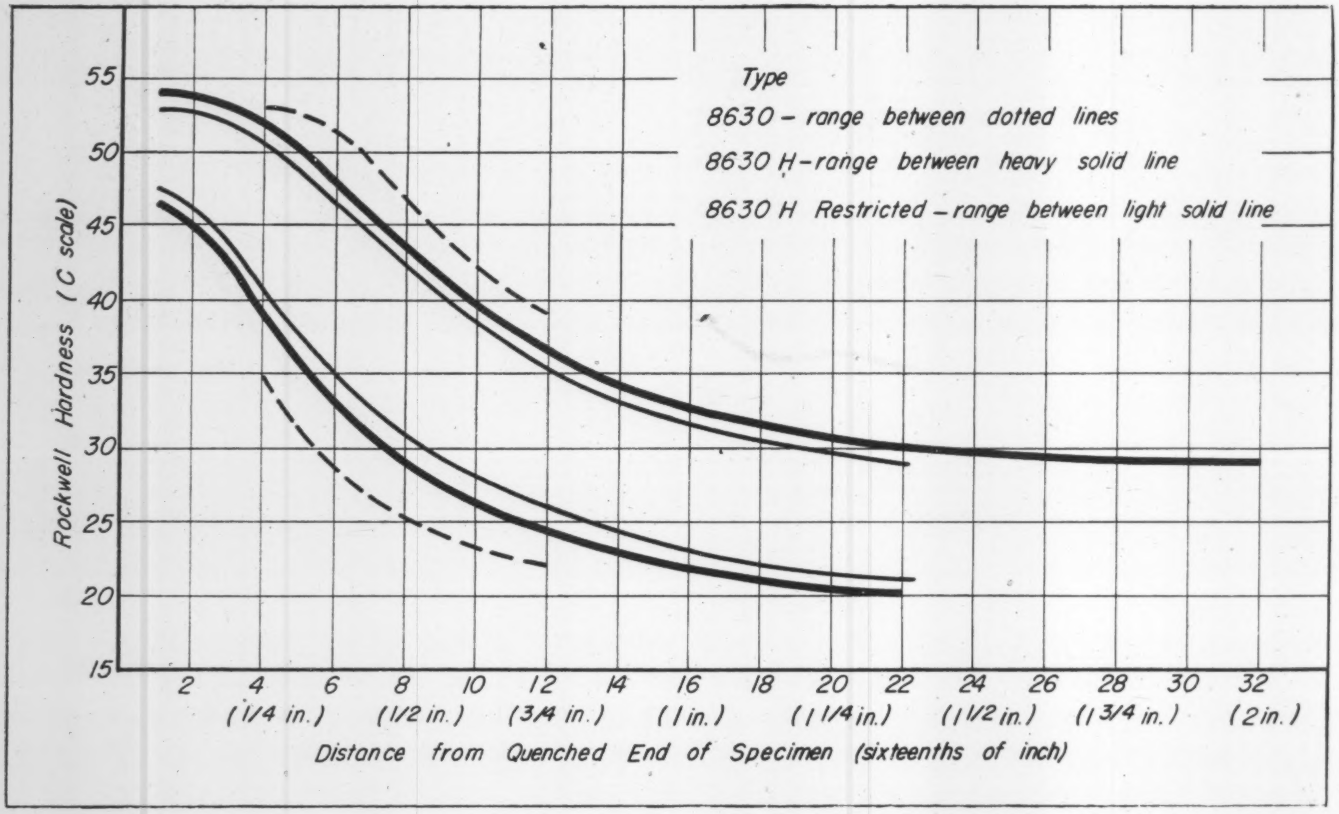

Fig. 2—Hardenability bands for 8630 steel showing the approximate spread to be expected in the standard chemical grade and the tentative hardenability limits for the H and restricted-H grades

which these materials are processed into parts and assemblies rate high in importance and, indeed, many of the significant developments concern primarily the processing methods, *Fig.* 1.

Ferrous Materials

H Steels: The trend to hardenability rather than chemical specifications for constructional alloy steels is fast gaining momentum. Users are learning that the new "H" steels, in spite of their broader composition limits, behave in a more uniform manner than the standard chemical grades.

When steel is melted to hardenability limits with about the same percentage of rejections due to "off heats" as experienced when melting to chemical limits, the spread in hardenability is much less, *Fig.* 2. Uniformity in behavior is achieved simply by a change in point of view, at no increase in "off heat" rejections and, therefore, at no economic penalty. Reason for this is not hard to find. The number of heats which must now be rejected for hardenability deviation, though within the chemical limits, are balanced by an equal number of former off-analysis heats which are satisfactory from a hardenability viewpoint.

Hardenability band limits have now been developed for most of the popular grades and have recently (June 1947) been jointly issued by the Society of Automotive Engineers and the American Iron and Steel Institute in a booklet entitled "Hardenability of Alloy Steels".

Restricted-H Steels: Steels with hardenability bands narrowed to three-quarters the width of the standard H band have recently been announced. The user may select the bottom, middle, or top three-quarters of the standard band. The middle restricted band for 8630 H is shown in *Fig.* 2. These restricted steels will command a premium over the regular H steels. Restricted-H steels represent another significant step toward uniformity for mass production and will undoubtedly find application where overall economy or performance justify their use.

Boron Steels: The phenomenal hardenability effect on steels of nearly infinitesimal contents of boron (0.003 per cent) is becoming better understood. Of the steels in which boron might find application, the low-carbon, deep-hardening carburizing grades appear to offer the most fertile field. These steels must now be highly alloyed to meet the hardenability requirement, but in so doing certain difficulties in fabrication are introduced.

Possibilities of reducing alloy content are attractive because boron is at its maximum effectiveness in low-carbon steels and because of the multiplying action of alloy additions. This action results in a small amount of a new hardening element introduced into the composition being as effective as large amounts of those already present. The reduction in alloy content effected by the substitution of boron should reduce some of the fabricating difficulties characteristic of these steels.

A recent announcement[1] indicates that these principles have been reduced to practice in a new series of deep-hardening carburizing steels. In these steels the hardenability of the 3300 and 9300 carburizing grades has been conferred upon a modified 4300 base analysis by the addition of vanadium and boron, the hardenability of 4815 has been met by the addition of boron to 4615, and the hardenability of 4317 met by the addition of boron to 8615. These new grades are said to have improved car-

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[1] References are tabulated at end of article.

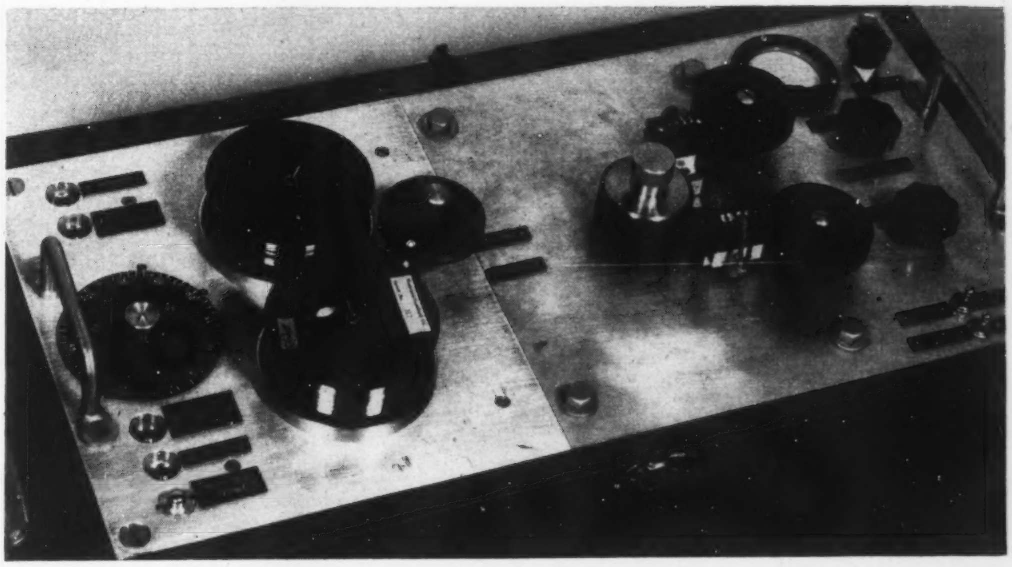


Fig. 3—Right — Armour Master Wire Recorder developed to make original recordings from live performances for later commercial duplication. Frequency response is 40 to 15000 cycles per second using 18-8 stainless wire

burizing, annealing, and machining characteristics as compared to the standard grades of equivalent hardenability, while mechanical properties after carburizing and hardening are retained.

STAINLESS STEELS: In the chemical industry, increasing use is being made of special low-carbon (0.03 per cent max) austenitic stainless grades in services where stabilized grades would have been applied previously. The special low-carbon grades have the advantage that they require no stabilizing treatment after annealing to develop their stability. Their resistance to sensitization in the temperature range of carbide precipitation is of the same general order as that normally expected with the stabilized grades.

A development recently reported[2] was the successful replacement of 17 per cent chromium with modified types of 12 per cent chromium in petroleum refinery vessels operating within the range of 500 to 1000 F. While not a new application, the record of experience from 1936 to date, with only six known instances of embrittlement, is noteworthy. This lack of 885 F embrittlement is a welcome contrast to the behavior of 17 per cent chromium in the same service, and the corrosion resistance is stated to be adequate for such equipment.

A new nickel-manganese-chromium steel which can be drawn into wire having a tensile strength of 250,000 to 280,000 psi has been developed for aircraft control cables. Its coefficient of expansion is similar to that of structural aluminum alloys over a wide range of temperature. Thus, once adjusted, cable tensions are maintained at any altitude.

TOOL STEELS: To satisfy the continuing desire for superior high-speed tool steels, recent developments have pushed carbon and vanadium contents as high as 2 per cent carbon and 5 per cent vanadium. One per cent columbium has been used for added abrasion resistance in another composition.

A somewhat opposite problem is the need of the plastics industry for better machinability of hardened steels used in large molds such as those for molding portable radio cabinets. This problem has encouraged the development of a new steel for which machinability at a heat treated hardness of 300 Brinell is claimed to be substantially equivalent to the machinability rating of some of the

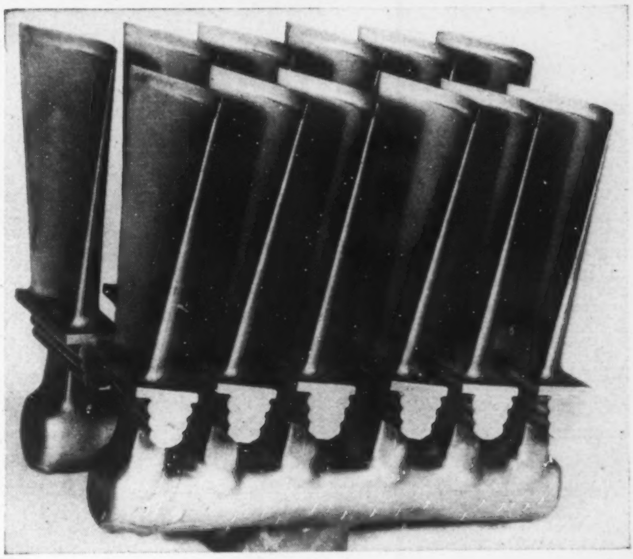
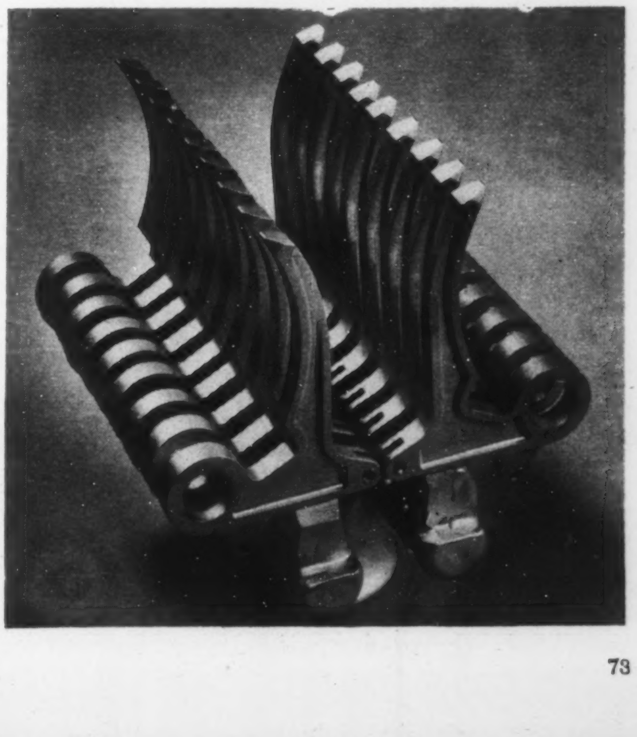


Fig. 4—Above—Group of jet-engine turbine blades produced by precision investment casting from Vitallium alloy

Fig. 5—Below—Eighteen-piece cluster of stainless-steel network protector latch castings, precision investment cast

Photo courtesy Westinghouse Electric Corp.



older steels at a much lower hardness level.

Interest of tool heat treaters in air hardening die steels continues. Such steels are much freer from dangers of cracking and distortion during heat treating than the older oil quenched varieties. In this class a recent grade contains 0.70 per cent carbon, 2 per cent manganese, 1 per cent chromium and 1.35 per cent molybdenum, and is said to harden in air throughout an 8-inch section to Rockwell C-60. The recommended heat treating temperature of 1550 F is low enough to minimize scaling and distortion during the heating operation.

Another old problem, especially with tool steels for large dies, is the nonuniformity in large bars of high-speed and high-carbon, high-chromium steels. Such nonuniformity, known to the metallurgist as carbide segregation, is said to be reduced with recent developments by several of the tool steel manufacturers.

Fine Wire: Two new developments now in the initial production stage show promise of a greatly expanded market for fine steel wire. One is the substitution of steel wire cords for cotton, rayon or nylon fiber cords in heavy-duty pneumatic tires. The other is the development of the magnetic wire recorder. The potential use of fine wire in these two industries assumes enormous proportions in comparison with present uses.

Culminating several years intensive research and development work, the magnetic recording and reproduction of sound on wire is now a commercial reality. The recording medium itself is a fine steel wire, 0.004-inch in diameter, drawn by special practices to develop the desired magnetic characteristics. Magnetic recorders which served the Armed Forces during the war employed carbon-steel wire for recording of speech. To provide high-quality reproduction of speech and music in present-day applications, *Fig.* 3, a recording medium of 18-8 type stainless steel has now supplanted the carbon-steel wire.

Composition control and processing practices have been developed to attain coercivity values between 200 and 300 oersteds and retentivity limits of 1000 to 3000 gauss. These and other basic magnetic characteristics which are controlled, provide a recording medium suitable for high-fidelity reproduction when used with the proper associated equipment.

Nonferrous Materials

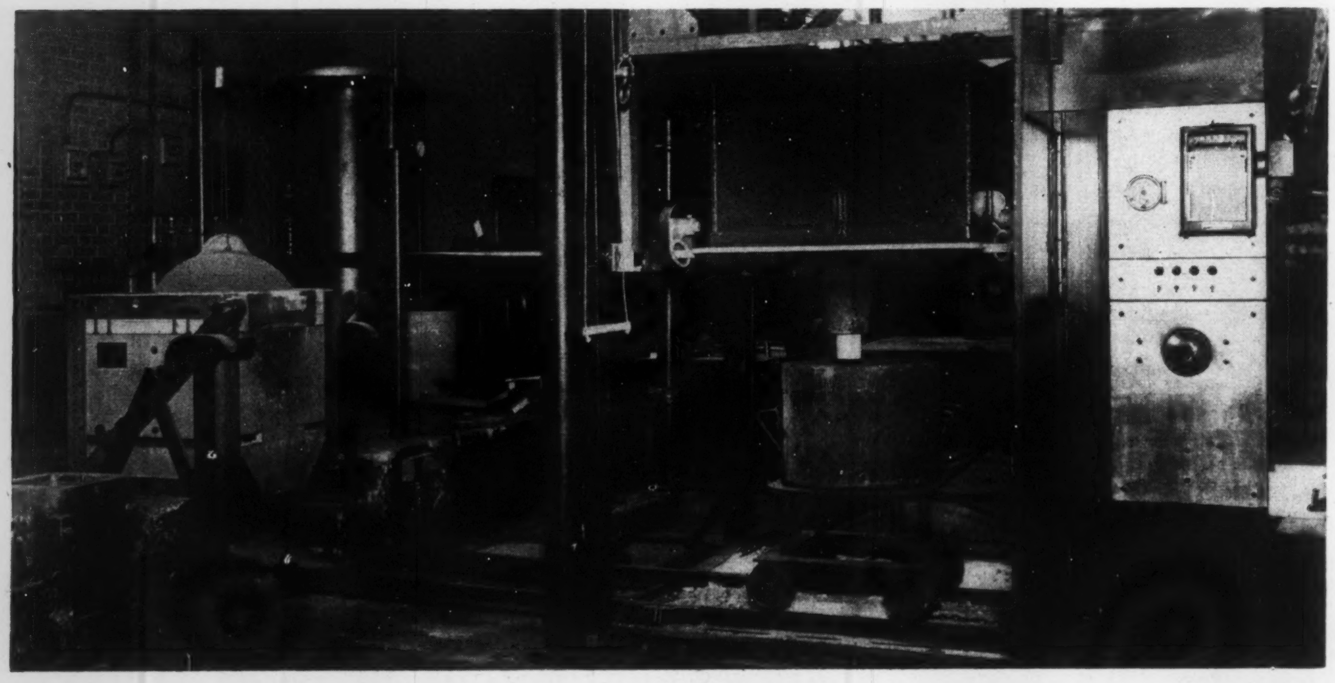
A desire to apply the greatly expanded production capacity for aluminum and magnesium has resulted in the development of many new peacetime applications. Among the examples of new uses is a portable irrigation pipe, 20-foot lengths of which at 4-inch diameter weigh only 19 pounds. The material is a high-strength heat-treated aluminum alloy.

Aluminum sheet is encroaching somewhat upon markets previously supplied by steel. Some examples are industrial and farm roofing, truck and trailer bodies prefabricated in sections, and the cabinet and food compartment liner in a new home freezer weighing only 185 pounds. In the instance of the trailer coach, the roof ends are being cold drawn from 60 x 120-inch sheet of 0.051-inch 3S-O alloy using the Kirksite die technique recently developed by the aircraft manufacturers.

Magnesium too is being applied as a sheet material in truck bodies, an example of which weighs only 1061 pounds compared to 2300 pounds when steel was used. Another new application utilizing the nonsparking characteristics of magnesium is car loading tubes for transferring liquid fuel[3].

Secondary Aluminum: Great strides have been made in the refining of secondary (scrap) aluminum so that it is now possible to produce first quality 17S or 24S sheet from substantially a 100 per cent aircraft scrap charge. The scrap is melted on a sloping hearth which permits the aluminum to melt away from any iron present and run down to the holding hearth. A reducing atmosphere prevents further oxidation, and nonmetallic materials and dis-

Fig. 6—Below—Counter-gravity casting machine developed by Armour Research Foundation for Wetherill Engineering Company. Note control station at right, vacuum box which covers mold and suction gate or spout below box



solved gases are effectively removed by use of a combination of solid and gaseous fluxes[4].

These developments help to keep the price of aluminum down in spite of rising prices for other metals. Another accomplishment is that many excellent secondary casting alloys are now available at prices lower than for the primary alloys. With an improved price relationship there is little wonder that the secondary alloys are being applied widely.

New Magnesium Alloys: Recent emphasis has been placed on developing improved properties in magnesium alloys in order to extend their use in aviation where the higher cost of magnesium is most easily justified. This has resulted in introduction of two new alloying elements, namely, zirconium and cerium.

Zirconiuum promotes fine grain structure and raises the melting temperature thus permitting much higher extrusion speeds. A new alloy of magnesium with zirconium and zinc (ZK-60) offers a better combination of tensile strength and toughness than the older commercial magnesium alloys. A comparison of properties is shown in the accompanying table.

Toughness and Strength of Alloy with Zirconium in Comparison with Commercial Magnesium Alloys

Alloy	ZK-60	FS-1	J-1	0-1 HTA
Nominal Composition (per cent)	Zn 5.0 Zr 0.75	Al 3.0 Zn 1.0 Mn 0.3	Al 6.5 Zn 1.0 Mn 0.2	Al 8.5 Zn 0.5 Mn 0.2
Rupture energy* (in-lb)	15.0	15.3	15.6	3.1
Tensile Strength (psi)	49,000	37,700	42,800	52,800
Tensile Yield (psi)	40,000	24,800	24,500	35,100
Elongation in 2 in. (%)	9.5	15.2	16.8	10.8
Compressive yield (psi)	35,000	14,700	14,900	34,400

* Slow bend of sheet specimen with side notches.

The cerium alloys have been developed for their creep resistance at elevated temperature where cerium has resulted in noteworthy improvement. For example, at 300 F the new forged alloy EM-22 (2 per cent cerium, 2 per cent manganese) creeps 0.3 per cent per 100 hours under 20,000 psi stress whereas the older forged alloy O-1 HTA (8.5 per cent aluminum, 0.5 per cent zinc, 0.2 per cent manganese) creeps at a rate of 0.7 per cent per 100 hours under 4000 psi stress[5].

Copper Alloys: Probably because the recent demand for copper and copper alloys has greatly exceeded the supply, developments in this field have not received much publicity, although several are under way. In one case, as a result of improved insulation, the electrical industry is tending toward the use of higher operating temperatures which soften copper during service. This challenge is being met by the addition of small amounts of silver to raise the recrystallization temperature with practically no effect on conductivity. The addition of other elements for greater improvement is being studied.

Consideration is being given to the difficult problem of machining copper and the high-strength, corrosion-resistant silicon bronzes. Free-machining coppers containing small amounts of selenium or tellurium, which have little deleterious effect on conductivity, are now on the market. An aluminum-silicon-bronze (7 per cent aluminum, 2 per cent silicon, 91 per cent copper) with tensile and corrosion properties similar to silicon bronze is now being used in increasing quantities. This alloy has 65 per cent relative machinability (free cutting leaded brass = 100 per cent) compared to about 25 for the older silicon bronzes.

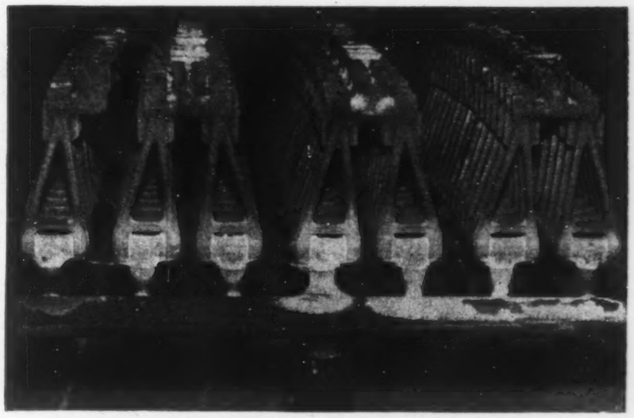


Fig. 7—Multiple-mold castings poured simultaneously by the counter-gravity process

High-strength, high-conductivity copper alloys such as chromium-copper (75,000 psi tensile strength, 80 per cent conductivity) and high-strength alloys such as beryllium copper (180,000 psi tensile strength) are receiving greater consideration and finding new applications for example in circuit breaker arms and springs, respectively.

High-Temperature Alloys: Wartime and post war developments in the field of jet propulsion and gas turbines have placed considerable emphasis on the metallurgical development of alloys suitable for use at higher temperatures. These generally fall into three classes based on service temperature. Iron-base alloys, for example, (16 per cent chromium, 25 per cent nickel, 6 per cent molybdenum) are being used for service up to 1200 F.

A number of wrought heat-treatable alloys have been developed for service at 1200-1350 F. Among these are several nickel-base alloys containing chromium with aluminum and titanium added for precipitation hardening; several nickel-chromium-cobalt-iron alloys; and nickel-molybdenum alloys. These alloys may be forged and pressed into shape and are being employed for turbine blades and other engine parts after precipitation hardening.

For service at 1500 F, cobalt-base cast alloys (cobalt-chromium-molybdenum) have been judged most suitable. These alloys are generally precision cast and probably retain their strength by the gradual and constant precipitation of strengthening phases at operating temperature[6].

Processing Methods

Use of Castings: Despite the obvious advantages of castings, their use began suffering a temporary setback several years ago. This was partly due to encroachment by electric welding processes and partly because of slowness in the foundry industry itself to join the trend toward industry advancement through research and development. Fortunately this situation is rapidly righting itself. War and postwar modernization of foundries has aided the economic factor. Of equal importance, the number of new developments in foundry processes, materials and methods is now becoming quite significant.

Sand Cast Products: This, the largest group of cast products, has profited or will profit soon from a number of developments in molding sand technology. The most important has been the application of thermosetting plas-

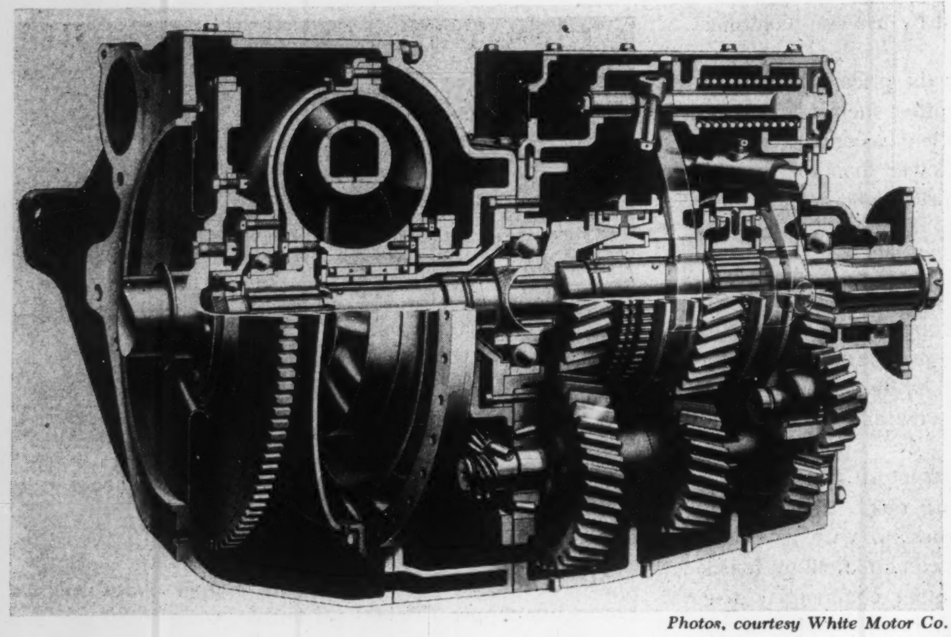
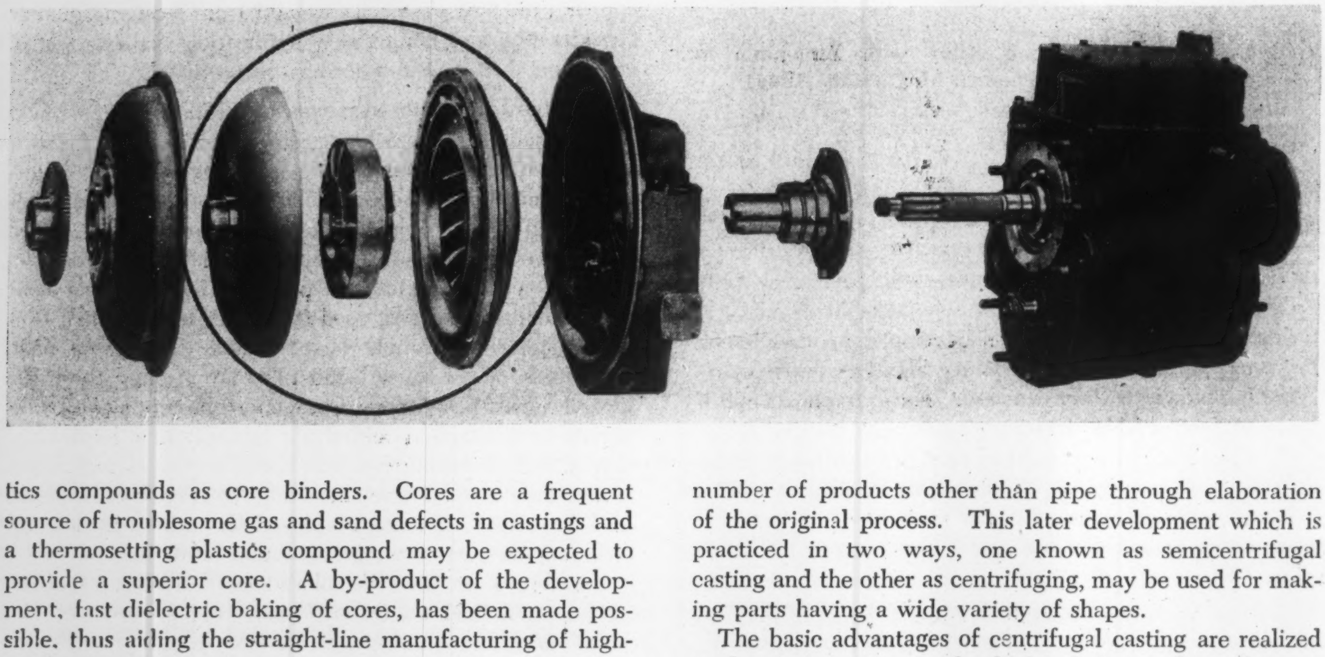


Fig. 8—Left—New automatic bus transmission, combining the advantages of both hydraulic torque converter and coupling. Converter-coupling castings have been replaced by brazed assemblies

Fig. 9—Below—Exploded view of the White Hydro-Torque drive showing the three brazed-aluminum members of the converter-coupling. The brazed assembly cost less than half the original cast parts and proved over twice as strong

Photos, courtesy White Motor Co.



tics compounds as core binders. Cores are a frequent source of troublesome gas and sand defects in castings and a thermosetting plastics compound may be expected to provide a superior core. A by-product of the development, fast dielectric baking of cores, has been made possible, thus aiding the straight-line manufacturing of high-production castings.

Increased knowledge of the control of metal solidification constitutes another important phase in the foundryman's campaign to improve his product. The important purpose here is to eliminate metal unsoundness and internal cavities caused by volumetric shrinkage as a casting solidifies. Two recent contributions pertain to mathematical calculation of sizes of gates and risers[7, 8]. Others cope with the riser problem by applying an exothermic coating to the riser cavities[9, 10]. The older atmospheric pressure or "Williams" riser method also is finding increasing application. A more recent modification known as the "Washburn" riser[11] offers an advantage of easy removal of the riser from the casting.

Another effective scheme developed for promoting feeding of castings, which so far has been applied to nonferrous castings, is that of the insulated riser developed by Taylor and Wick[12].

CENTRIFUGAL CASTING: This method, rather old now in the pipe industry, has been extended in recent years to a number of products other than pipe through elaboration of the original process. This later development which is practiced in two ways, one known as semicentrifugal casting and the other as centrifuging, may be used for making parts having a wide variety of shapes.

The basic advantages of centrifugal casting are realized to the utmost in parts of cylindrical shape where the centrifugal force may be used to form the internal diameter without benefit of a sand core. Noncylindrical shapes sometimes can be made to advantage by the process, the benefit being in rapid filling of the mold or a greater freedom from slag entrapment. During the past year a large machine was built to centrifugally cast welding rods.

DIE AND PERMANENT-MOLD CASTING: Since the war ended, the popular nonferrous die casting and permanent-mold casting alloys have of course made a rapid comeback. The most important development in this field unfortunately is not yet a significant commercial reality, i.e., the die casting of copper alloys. The missing link is the need for a mold alloy somewhat better able to resist erosion and heat checking than any commercial alloy yet developed. There is little doubt that this development will be an accomplishment soon.

The permanent-molding of gray iron and steel, especially the former, are receiving greater emphasis. Die or pressure casting of these metals, however, awaits development of a greatly superior mold alloy.

Precision Casting: The so-called precision or investment casting of machine parts began during the war as a commercial process. Precision-cast parts can be made to have approximately the same preciseness of dimensions and intricacy of shape as die castings of zinc and aluminum. However, the alloys cast are not limited to the relatively low-melting point nonferrous alloys.

War-time application, while large, was limited to a relatively few high-production items, particularly refractory alloy blades for turbosuperchargers. After the close of the war precision casting application was limited severely. The new jet-propelled aircraft required some blade castings, *Fig.* 4, for their gas turbines but considerable effort was made to develop new fields of application.

Future of Investment Casting Promising

While the process still is somewhat limited due to high basic cost, a promising future is anticipated. Continuing research and development are being directed toward the economics of the process. Some of the more promising outlets being found are, 18-8 stainless-steel parts of all types, wear-resisting latches, triggers, levers, and gears made of alloy steels and the hardenable stainless steels, and tools, dies and molds made of tool steels and other alloys, *Fig.* 5.

Vacuum Casting Processes: A new development expected to have considerable significance to the foundry industry is known as counter-gravity casting[13]. This process, *Fig.* 6, is based on controlled vacuum pouring, that is, sucking of metal from a special holding ladle placed beneath the mold and connected to the mold by an inverted gate or spout.

Besides having a number of economic advantages arising from improved yields, the process for the first time engineers the pouring of molten metal through instrument control. Control of the pouring variable eliminates one of the most prevalent sources of defects in castings, *Fig.* 7. The process offers also a means of elimination of slag and gets away from violent agitation of metal inherent in some types of casting processes.

The use of vacuum in melting and casting is not basically new[14]. Laboratory installations for preparation of high-purity metals and alloys have been in use for some years. These usually employed a sealed chamber containing both melting unit and mold with remote control of pouring. German developments during the war applied units similar to those used in laboratories in this country to the commercial production of castings of high purity, stainless and heat-resistant alloys.

Arc Welding: An important development in this field has been application of the lime-ferritic electrode to welding of carbon and low-alloy steel. Previously used for welding of armor plate and stainless steels, this type of electrode eliminated much of the trouble with underbead cracking which had been encountered under some conditions with older types of electrodes.

A new type of automatic electrode construction which was announced recently eliminates the need for slotting the nonconducting coating for electrical contact. Claims are better metal transfer and atmospheric protection.

Inert-Gas Welding: Helium-arc welding was developed during the war for the joining of magnesium and recently has been applied to the fluxless welding of aluminum and some special alloys. Similar developments involved the use of argon and helium for protective atmospheres in the welding of stainless steel tubing. Special electrical apparatus has been developed for these inert gas processes.

Resistance Welding: Resistance welding developments have resulted in establishment of two types of welders, the continuous ac and the discharge welders. The former now is applied widely for joining steel, nickel and other high-resistance alloys, while the latter is used on aluminum, magnesium and some copper-base alloys.

Rare was the fabrication plant a few year ago that did not have to "overweld" to safeguard the product because

Photo, courtesy F. J. Stokes Machine Co.

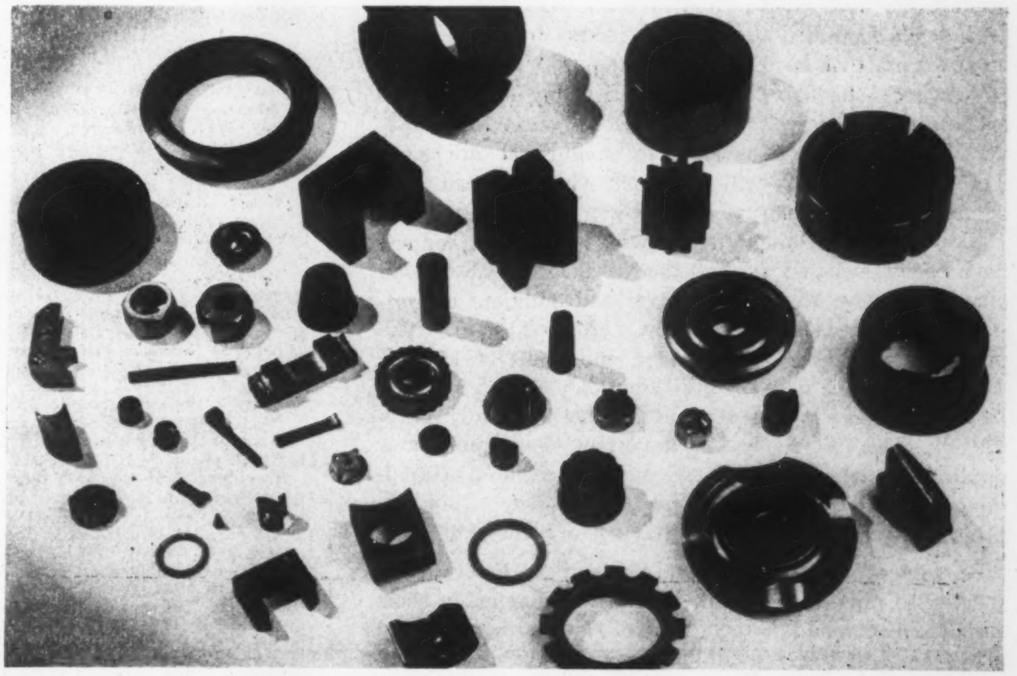


Fig. 10—Right—Variety of intricate, precision machine parts mass-produced from a variety of powder metals

of poor equipment and power regulation. Developments of voltage and current-control devices have overcome this major drawback to the application of ac spot welding. Modernization of welding facilities with these control devices during the last year is well worth noting. Hardenable steels were not previously spot weldable. Post heat treatments in the welder added this important group of sheet material to the spot welding list.

One interesting development in the equipment line is a three-phase welder which rectifies alternating current and sends a direct-current impulse of 1/10 second or more through the weld being made. Advantages of this type of equipment may be realized where there is variable iron in the throat and where power lines are inadequate. High power factors are claimed. More new equipment may be expected as electrical circuits are developed to meet the needs of resistance welding.

Brazing Field Extended to Aluminum

Brazing: Furnace brazing has been a proved means of economically fabricating many steel and copper-alloy assemblies for several years but has only recently been successfully applied to aluminum alloys.

A new motor bus utilizes a furnace brazed aluminum torque converter, *Fig.* 8, which is a critical and major size item riding between the engine and gear box and transmitting over 200 hp. This torque converter is 16 inches in diameter and consists of three pieces rotating on a common axis, the first being a centrifugal pump driven by the gas engine, the second a hydraulic turbine driven by the pump and keyed to the drive shaft, and the third a bladed reaction member nested between the two, *Fig.* 9. The brazed assembly is quenched and aged. The cost is less than half of the casting it replaces; it has over twice the bursting speed of the casting, and the efficiency as a power transmitting unit is greater[15]. Improved aluminum brazing alloys, fluxes, atmosphere and temperature control, and the development of aluminum-alloy sheet coated with brazing alloy have all helped to make this possible.

In the domestic gas-range industry, both top and oven burners are now being made of steel stampings copper brazed in controlled-atmosphere electric furnaces. Advantages are that no machining is required and exact dimensions can be held, simplifying assembly of the burners into the gas stove. Smooth surfaces mean less resistance to gas flow and increase in combustion efficiency. The brazed assembly will not break when dropped, and overall cost is less than for the cast-iron burner replaced[13].

Two new silver-brazing alloys with lower silver content have been developed to offset the rising cost of silver. One alloy containing 45 per cent silver and additions of copper, zinc, and cadmium melts at 1120 to 1145 F. The other contains 35 per cent silver, and melts at 1115 to 1295 F. A third new silver-brazing alloy with a reported melting temperature of 1076 F has been recently introduced. This should be an important development for applications where temperature must be held to a minimum as the lowest-melting-point brazing alloy of suitable properties previously available has a flow point of 1175 F.

Soldering: Although the tin fields of the Far East are starting to produce again, this metal still remains in short supply and demands a record price. Hence the lower tin alloys are still being used for many applications.

The difficult problem of soldering passivated zinc-coated articles has been alleviated by development of a new soldering flux. This has permitted use of a passivated zinc plate rather than cadmium plating with substantial cost saving on many products including electrical parts for radios, air conditioning and refrigeration equipment, hardware, hand tools, and automotive parts[16].

Powder Metallurgy: Considerable emphasis is being placed on the manufacture of parts from powdered metals, *Fig.* 10. With relatively low-cost iron powder available (about 8.5c per lb), consideration is being given to possible cost reduction through the use of close-dimension powdered-iron compacts for small parts formerly machined from castings.

A close-coupled cluster gear set of high accuracy is a part which cannot be produced by normal machining methods but can be readily made from powdered metals. The entire tooling program for this part was completed in a few weeks and production started three days later. This is just one example of a highly stressed part now being made by powder metallurgy to replace heavy stampings, steel bars, or steel forgings[3].

A method of embedding machinable materials into sintered carbide parts so that the parts can be mounted or attached with screws or studs has been developed. This should extend application of carbides, especially in large sections. Tapped blind holes can be used for bolting down large parts to permit unbroken wear surfaces. This method also gives greater impact resistance as the threaded parts can seat solidly against the backup metal. A complex die can be assembled from groups of small individual units as in a progressive die[3]. Considerable emphasis is also being placed on the development of carbides for abrasion-resistant applications.

Powder metallurgy alloys as differentiated from cast alloys are coming into use. A new permanent magnet material composed of cobalt, copper and nickel has been developed. It is sintered above the melting point of copper, is machinable after heat-treatment and has a higher coercive force than Alnico. A cupro-nickel sintered alloy with controlled porosity was used during the war for deicing aircraft[6].

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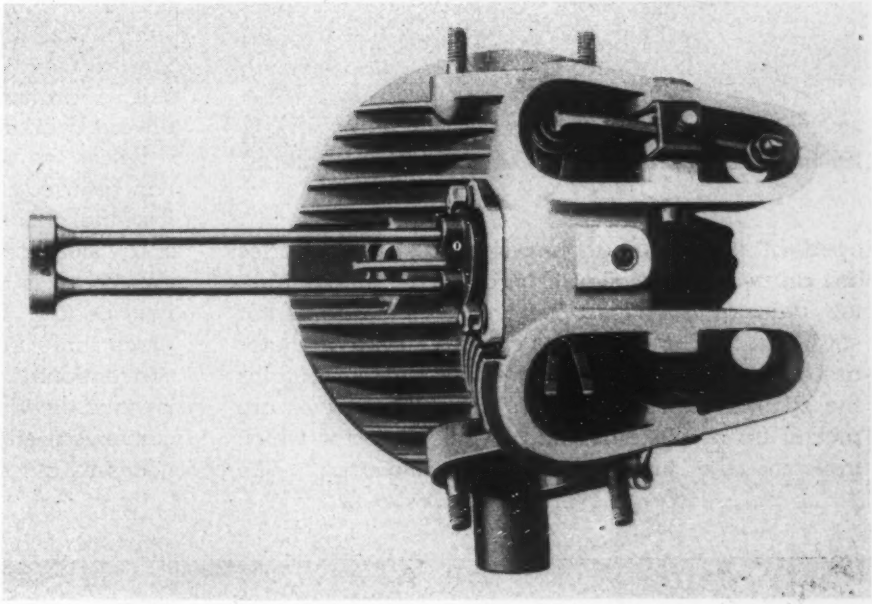
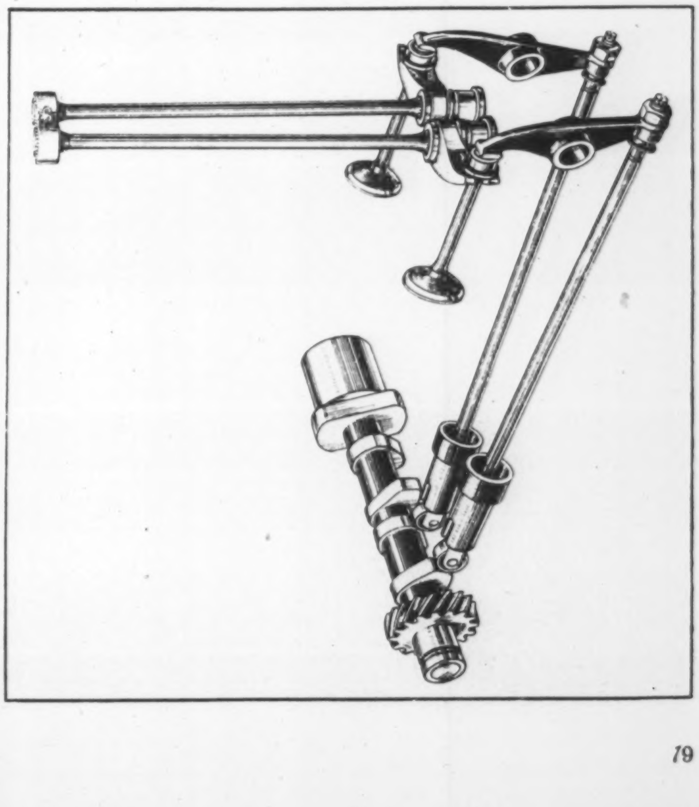
Scanning THE FIELD for Ideas

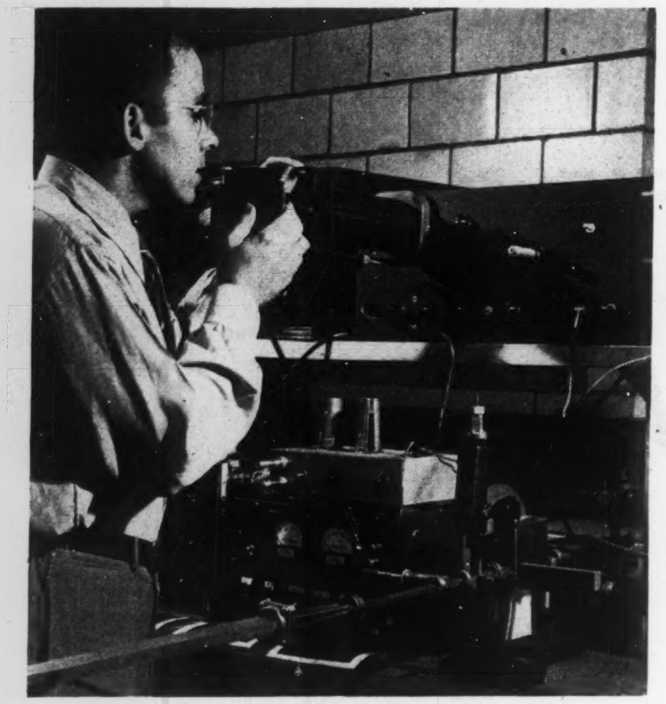


TORSION bars are utilized in an interesting and unusual manner in the Panhard Dyna automobile. As shown in the photograph, right, and the pictorial drawing, right below, twin torsion bars replace the conventional springs on each pair of intake and exhaust valves in the engine. For the two valves in each cylinder, two half bars are joined at the far end, economizing on material and making the assembly less cumbersome. This assembly is alternately loaded by the intake and exhaust motions. At each motion of the cams, the two bars twist simultaneously. The anchorage point, therefore, is the seating position of the opposite valve. In their action the bars are virtually motionless and inertia problems are minimized, compared with the movement of conventional valve springs.



Identification of whole molecules of chemical substances may be made with a microwave spectroscope, using radar waves from 1.2 to 1.6 centimeters in length. In this way complicated molecules such as hydrocarbons can be analyzed. When microwaves are beamed through the vapor of the substance to be analyzed, certain wavelengths are absorbed by those molecules which they cause to rotate in resonance. Thus for each substance there is a characteristic pattern of absorption lines which when projected electronically on a screen are easily identified.

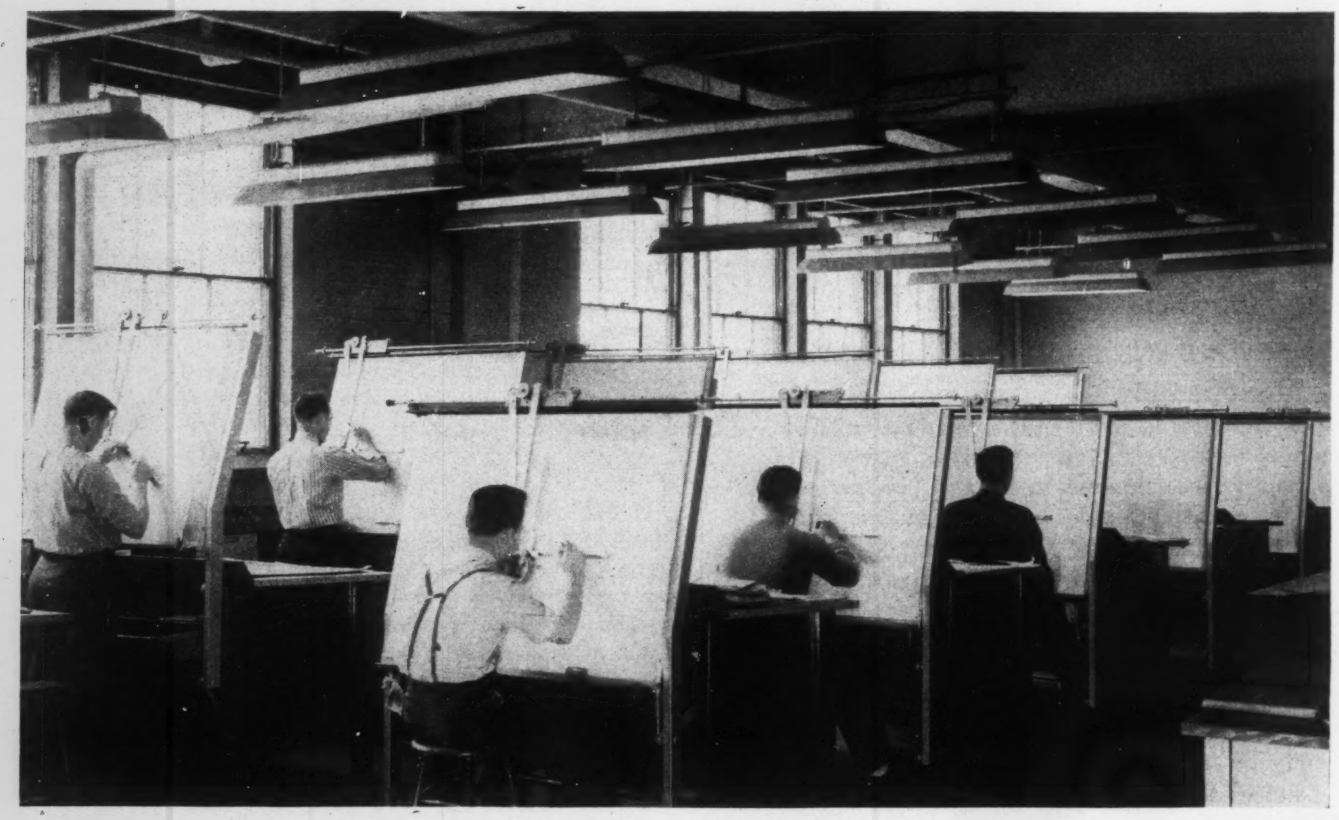
Basic elements of the spectroscope devel-

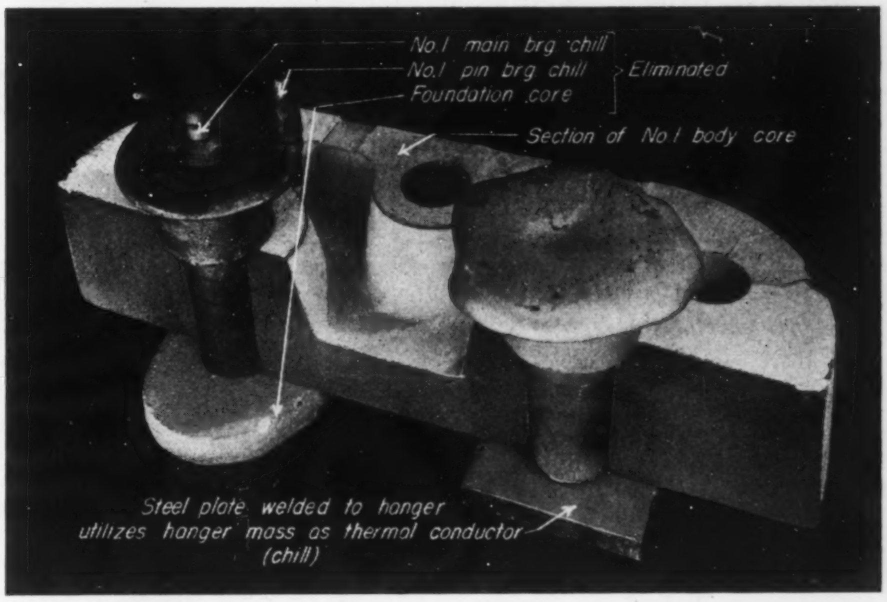


oped at the Westinghouse Research Laboratories are an oscillator (reflex klystron) waveguide, crystal detector, oscilloscope and sweep generator shown above. Microwaves emitted by the oscillator are directed through the waveguide which contains the sample vapor to be analyzed. The waves are picked up at the other end by the detector which transmits the impulse to the oscilloscope. The waveguide is the long slender tube extending out of the lower left of the photograph. Compounds which have been identified include ammonia, water vapor, acetone, cyanogen bromide, and carbonyl sulfide. The instrument promises to be a valuable tool in the study of molecules and atomic nuclei.

Upright drawing boards, below, were built by Baker Perkins Inc. as a solution to a problem of providing more space for additional draftsmen. Floor space for flat boards and reference tables was not available. The boards are mounted on a parallelogram linkage and are counterbalanced so that they will stop in any desired position. By the use of ball bearings on the main shafts, the board can be moved vertically with little effort. As a result, a draftsman moves the board so that he is always working in a convenient position.

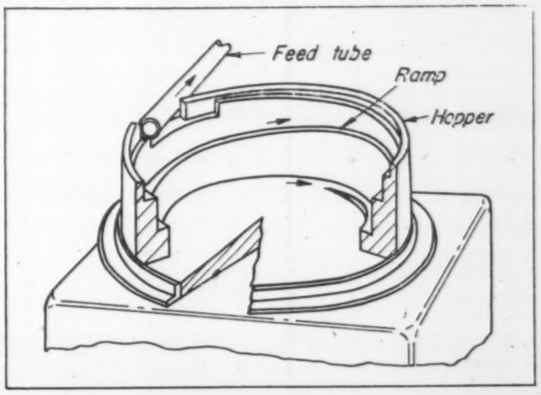
Below the drafting board is a sliding shelf which can be used for books and reference material. Below the shelf is a set of metal cabinets for tools and reference drawings. The reference table of one board is used by the draftsman working on the next board. This arrangement makes it possible to place three men in a space occupied by two with conventional boards and reference tables. Also it permits the draftsman to do most of the work in a convenient sitting or standing position without the necessity of leaning over a board.




No. I main brg chill
No. I pin brg chill
Foundation core
Eliminated
Section of No. I body core
Steel plate welded to hanger utilizes hanger mass as thermal conductor (chill)

Stronger crankshafts as well as saving of a half million dollars in manufacturing costs have been achieved by a novel revision of molding techniques in the Ford Motor Company's Rouge plant. The new method utilizes the cooling capacity of the continuous conveyor hangers on which the crankshafts are poured in groups of four. The hangers, serving as a base for the vertical molds, promote the progressive cooling of the metal from the bottom up. In this way molten metal continually can fill for the shrinkage normally resulting from solidification. As a result, crankshafts possessing improved metallurgical qualities are obtained.

In the photograph, right above, are illustrated the former and present molding methods at left and right, respectively, for the lower section of the casting. The new method eliminates the costly practice of employing small cylindrical inserts or chills in each mold. These chills became an integral part of the casting and, since fusing was not always complete and moisture or foreign material often adhered to the metal, structural weaknesses resulted.



Hopper feed, illustrated at right, utilizes vibration for aligning blanks and introducing them into a centerless thread grinder. The blanks move, by vibration, up an inclined ramp on the inside face of the hopper wall. Since the ramp extends around the hopper one and one-half times, the blanks either become aligned or fall off and are fed into the machine in a smooth flow. Directional vibration is obtained by using one-half of the sine wave of alternating current through rectification. Since the feed tube is essentially horizontal, vibrations of the hopper carry through the tube. Adjustment of feed from creep to full speed is obtained from a rheostat adjustment.

The loader, designed by Landis Tool Co., readily handles blanks which are equal in length and diameter. In this case a small agitating platform or pan, with a hole in one corner, receives the blanks from the ramp. Because of the manner of securing this pan to the hopper, enough vibration is induced to make the blanks bounce across the hole. This hole is not large enough to permit a blank to pass through crosswise. Instead it quickly would bounce to an upright position and enter the hole. The feed tube, in this case, curves up under the hole and as soon as the blank goes through the hole in the pan it enters the tube. Since one side of the pan is open to the hopper, jamming cannot occur.

INCREASE
OFF
ON

Drawing Three-Dimensi

By W. E. Walters
*President, Institution of Engineering
Draftsmen and Designers
London, England*

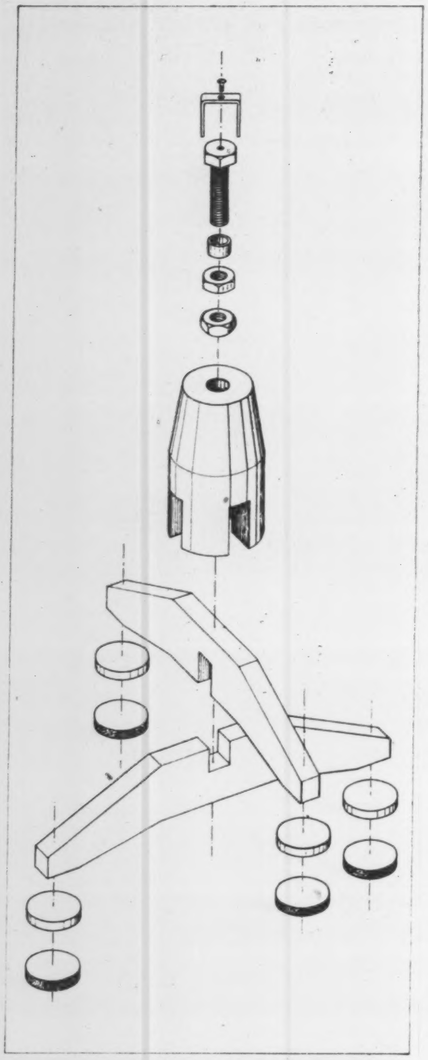


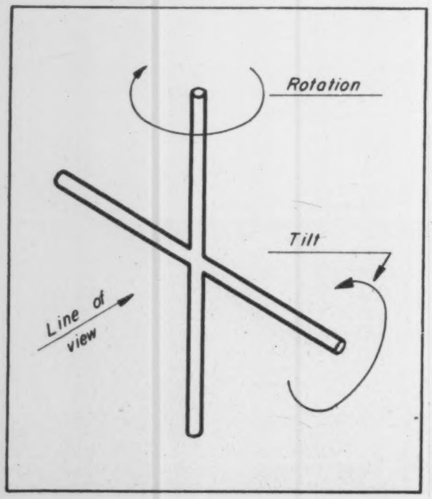
Fig. 1—Above—Typical exploded assembly. Drawings such as this can be rendered quickly with new, simplified drafting technique

RENDERING of three-dimensional assembly drawings and exploded views, *Fig.* 1, has been simplified greatly by a new technique which requires no artistic ability and achieves wholly satisfactory results through the use of ordinary compasses and triangles. Conventional orthographic drawings, thoroughly familiar to all draftsmen, form the basis for conversion from two to three dimensions. Elevations are used only to extract the vertical distances between base lines and upper items.

PRINCIPLES of a new, simplified 3-dimension drafting technique were explained in an article by the author in the January issue, dealing with the pictorial drawing of single parts. The present article takes the next step, explaining how this new technique can be used in the production of three-dimensional assemblies and exploded views of machine units

Three-dimensional translation technique falls into two stages in the same way as the visual impression of solidity depends on two factors, namely *rotation* and *tilt*. To insure absolute clarity regarding these terms, an imaginary matchbox will be used to illustrate their respective meanings. Starting with the position where the front elevation alone is visible, the matchbox must be turned on a *vertical* axis to bring the side elevation into view so that two faces of the box may be seen. This is rotation. Having incorporated the two elevations in this experiment, it remains to deal with the plan. Rotation alone cannot bring the horizontal faces of the box into the picture. That can only be achieved by turning it on a *horizontal* axis (any axis at right

Fig. 2—Below—Schematic representation of rotation and tilt, combination of which is required to obtain three-dimensionality



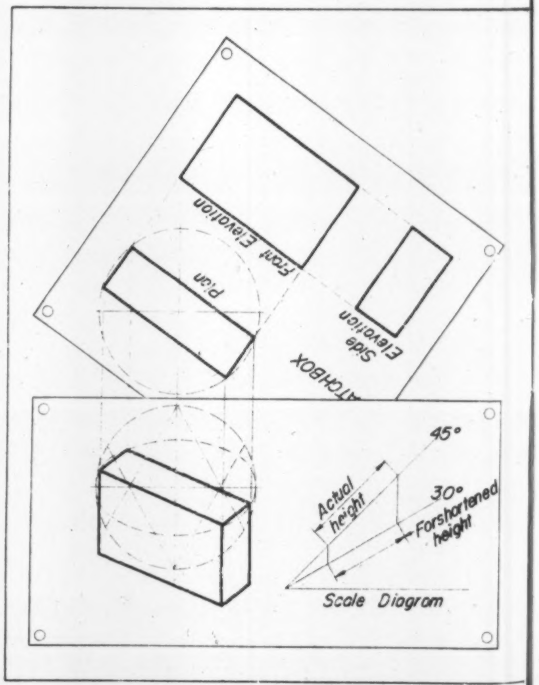


Fig. 3—Right—How three-dimensional view is projected from conventional orthographic drawing into standard ellipse. Vertical dimensions are foreshortened as shown in the scale diagram

sional Assemblies

angles to the previous one). This is tilt (see *Fig.* 2). A combination of rotation and tilt inevitably results in three-dimensionality.

The procedural sequence in this imaginary experiment is closely emulated in the new three-dimensional drawing technique which amounts to little more than "adding" rotation and tilt to an orthographic projection. There is nothing problematic about the procedure, in fact its simplicity is surprising. Rotation, for instance, is effected by actually rotating the orthographic drawing into a new position on the board. Any oblique position will do, even if the drawing is turned upside down, as long as its outlines are no longer parallel to the T-square. A new sheet of paper should then be pinned over it in the normal position as *Fig.* 3 shows.

Next step is to deal with the second fundamental of three-dimensionality—tilt. It is common knowledge that a tilted circle appears as an ellipse, so it is only natural that this elementary fact should have its place in a technique which claims to be simple to understand and apply. However, before discussing the actual projection of the required shape view, the construction of the standard ellipse which "adds" tilt to the work must have attention.

The standard ellipse consists of two compass arcs which are so placed that they merge into an elliptical outline. The necessary data for striking these arcs are contained in its construction. The standard ellipse is a coincidence of ideal conditions where the axes, the arcs, their lengths, their contact points, centers, and radii are automatically obtained with a conventional compass and a 60-degree triangle. *Fig.* 4 explains the construction.

Referring back to the orthographic drawing, *Fig.* 3, which is to be translated three-dimensionally, a circle is circumscribed around the plan view and the proportionate standard ellipse is placed projectionally below it, i.e., on the same vertical center line. Any corner point which lies on the periphery of the circle must, obviously, lie on the standard ellipse also, because it is in fact the same circle in a tilted position. Thus by simply dropping projectors from the corner points of the orthographic plan, the three-dimensional location of these corners is no more then mechanical routine. When these points on the ellipse have been connected, the top face view is completed.

Side faces of the box incorporate the third dimension,

Fig. 4—Below—Standard ellipse is constructed with ordinary compass and 60-degree triangle

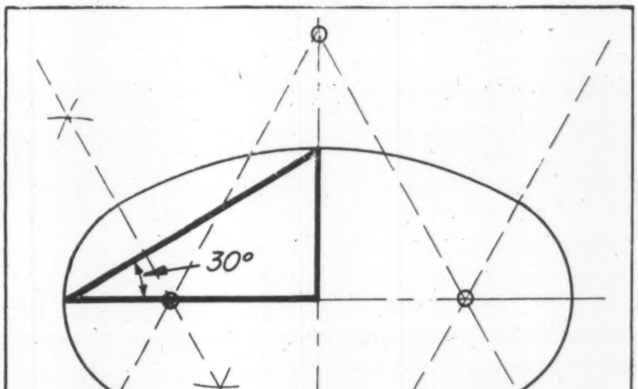
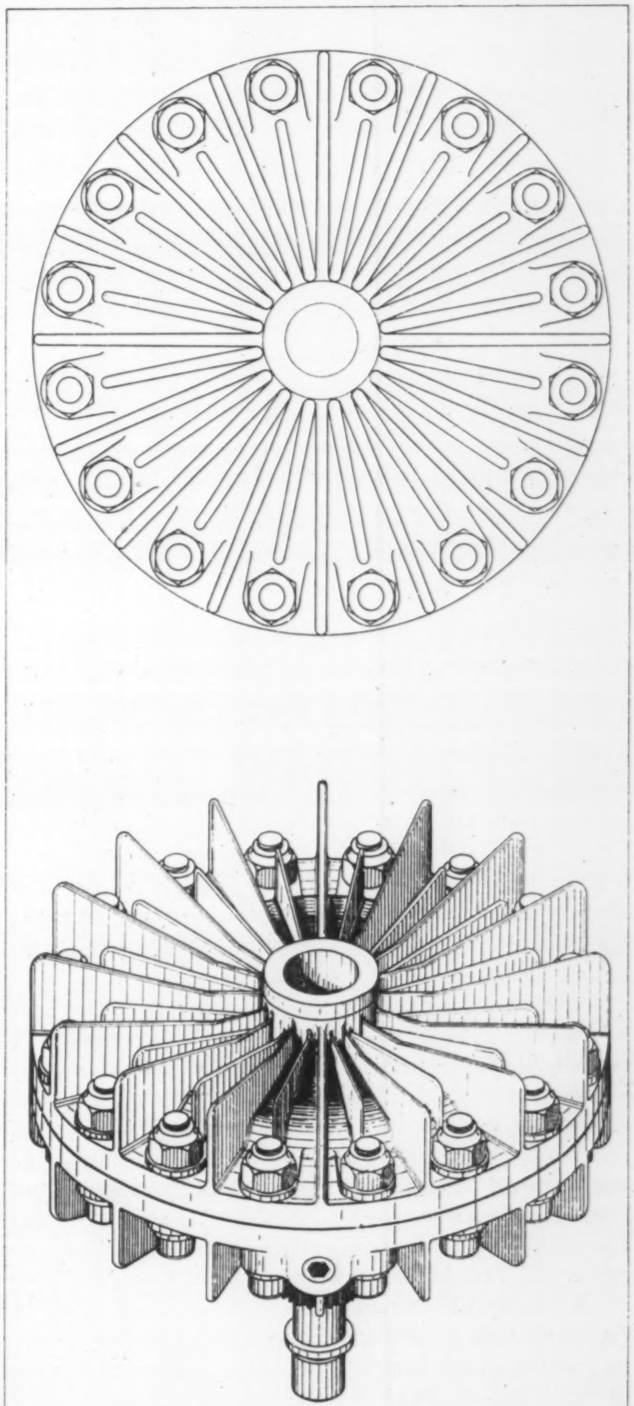


Fig. 5—Below—Assembly drawing of fluid coupling is made by simple projection from orthographic plan view at top



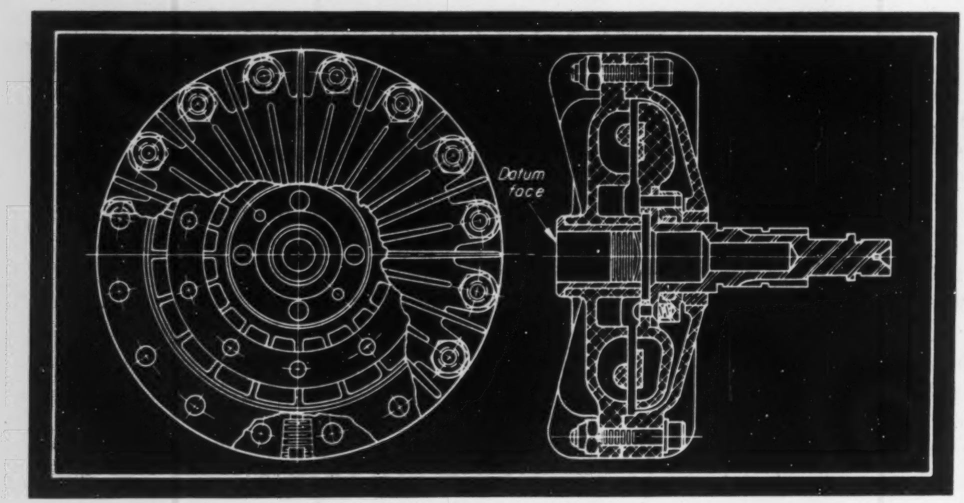
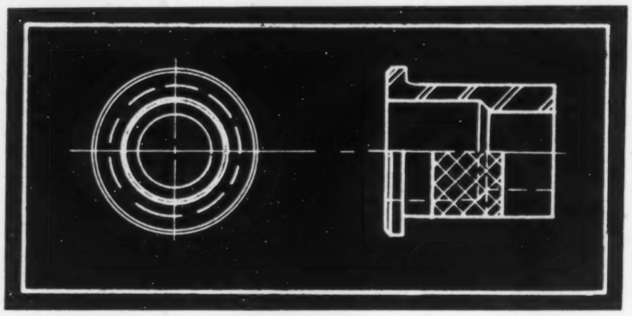


Fig. 6 — Left — Orthographic assembly drawing of fluid coupling which is shown three-dimensionally in Fig. 5

Fig. 7—Below—Orthographic detail of fluid-coupling impeller insert which is shown three-dimensionally in Fig. 8



height, and due to the tilting of the object the length of vertical edges must necessarily foreshorten. The 30-degree triangle in heavy outlines which can be seen in *Fig.* 4 points to an important relation between the standard ellipse and the standard foreshortening. Logically, they must conform to the same angle of tilt which in this method of drawing is constant. All orthographic measurements relating to vertical distances are correctly foreshortened by the 45/30 technique shown in the scale diagram of *Fig.* 3. The actual height of the box, as contained in the orthographic elevations is laid off on the 45-degree line and projected onto the 30-degree line. The "tilted" height is used in the three-dimensional view to obtain the bottom corners of the matchbox.

Method Applicable to all Shapes

Drafting room work, however, does not normally deal with objects whose form is as simple as a matchbox. Engineering components sometimes are quite complex where shape is concerned. It is therefore a comforting thought that the new drafting method is applicable to all shapes without exceptions, and that the principles are absolutely consistent throughout. *Fig.* 5, for example, in spite of its apparent involved nature, is merely the result of employing the standard ellipse as in *Fig.* 3. The practical aspect of the more complex object, *Fig.* 5, which is the energizer of a fluid coupling, provides ample scope for discussing how the new technique is used most expeditiously in preparing three-dimensional assembly drawings.

A glance at the orthographic plan above the shape view in *Fig.* 5 is sufficient to perceive that the assembly is essentially a round object in contrast to the matchbox which is wholly rectangular. What is the effect of rotation in such cases? A prismatic box continuously changes in outline but a phonograph record, being a typical representative of round objects, does not show such changes in outline. It appears as the same ellipse whether it is stationary or in motion. Consequently, where round objects are concerned, the draftsman need not bother about rotation at all since it does not affect the resulting shape view. He can project the orthographic plan without having to alter its position on the board. This has been done in the case of *Fig.* 5 and no time was wasted on preliminaries.

Another hint regarding intrinsically round objects concerns the crating circle. This must be added to angular objects to make conversion possible, but if the orthographic plan itself is round, the crating circle can be omitted. The plan outline as such can then be used to translate whatever items it surrounds, and the draftsman can save the work of the usual circumstructure and of course the subsequent erasure.

First thing which should be drawn in a spare corner of the sheet is the scale diagram (as in *Fig.* 3). When this is done the projection of the required shape view can start. The best procedure is to adopt the principle of working *from the top down.* This expression means exactly what it says, namely, that the top parts of the assembly should be drawn first and that the lower items should follow in sequence. The reason for this can be readily understood when it is realized that the topmost outlines must naturally prevent a substantial portion of the lower items from being visible on the drawing.

In the case of the fluid coupling assembly, *Fig.* 6, it can be seen that the center insert provides the highest face on the job. The large vanes do rise above that level but only around the periphery, and therefore it is the insert, *Fig.* 7, which should be drawn first. Its center line (horizontal) subsequently serves as a zero mark for the vertical spacing of all other details.

The principle of vertical spacing has already been discussed in connection with angular objects where the foreshortened dimensions are stepped off from corner points. On cylindrical shapes there are, however, no corners in that sense and the spacing is done from center to center as shown in *Fig.* 8. A moment's reflection will show that the horizontal center lines of the ellipses and part ellipses correspond to the planes in which they actually occur. As the distance between horizontal planes is a vertical dimension it must be foreshortened by the 45/30 method in order to obtain the spacings of the required centers. *Fig.* 8 also shows the method of drawing the standard elliptical outlines according to the construction shown in *Fig.* 4. The insert depicted in *Fig.* 8 has been completed only to illustrate a practical application and to show the procedure of vertical spacing. In the assembly view the lower portion of the insert is not visible and need not be drawn.

How Chamfers Are Drawn

A slight chamfer in *Figs.* 6 and 7 is indicated around the edges of the insert. It is so small—just the width of a line—that the draftsman can safely ignore it in this instance. As a matter of interest, however, it is apropos to study *Fig.* 9 which explains how a chamfer is developed in three-dimensional drawing in accordance with the principles of vertical spacing and foreshortening. *A*, *B* and *C* are three planes similar to those in *Fig.* 8. It follows that they receive similar treatment. The desired visual effect of a circular chamfer is produced merely by the size and vertical spacing of the two ellipses which describe the upper and lower edges of the chamfer.

When the visible outlines of the insert in the center of the assembly have been completed, the larger vanes which touch the circular outline in the orthographic plan, *Fig.* 5, should be projected. These vanes spring from the main body of the energizer, whose own outline, being a circle, serves to locate the three-dimensional position of each vane in the shape view. The vertical distance between the datum face (top of the insert) and the lowest root points of the vanes must be found. It is given in *Fig.* 10, one of the detail drawings belonging to this assembly. After that vertical distance has been duly foreshortened by means of the familiar scale diagram (45/30), the center of the appropriate ellipse for the vanes can be marked off. In *Fig.* 11 it lies in the bottom plane of the diagrammatic layout which shows the procedure in greater clarity. As soon as the requisite standard ellipse has been constructed, the peripheral endpoints of the vanes can be projected onto it. Ignoring the rounded parts for the time being, the orthographic distance between bottom and top planes in section *A-A* must now be foreshortened by the 45/30 method after which the resulting pictorial height can be laid off on the projectors from the points on the ellipse. In other words, the same distance is simply stepped off 16 times to determine the high points on the individual vanes.

The elevational section *A-A* reveals that there are two more points on each vane which must be plotted before the profile can be drawn. Normally only one more point would be required but there are two distinct sections to this particular profile; one at a slope and one horizontal. In the terms of older pictorial drawing systems this would be a case of "compound angle work" involving protracted calculations. Not so in this simplified technique which reduces even this type of work to the familiar construction tenets—the standard ellipse and the 45/30 foreshortening of vertical distances. The two vertical distances which are of importance to the draftsman are, firstly, that between the bottom and intermediate planes, and secondly, between bottom and slope centers. The diagram, *Fig.* 11, shows these planes in their orthographic and three-dimensional spacing.

Points on the profile of these vanes where the sloping and the horizontal sections meet obviously lie on a circle, a pitch circle as it were, and it follows that their location in the shape view can once again be obtained by means of the ubiquitous standard ellipse. The required points could be individually projected from the faintly drawn pitch circle in the plan view by conforming to the usual routine, but this is another occasion where time can be saved by forethought and common sense. It will be under-

Fig. 8—How vertical spacing is measured center-to-center in drawings of cylindrical objects

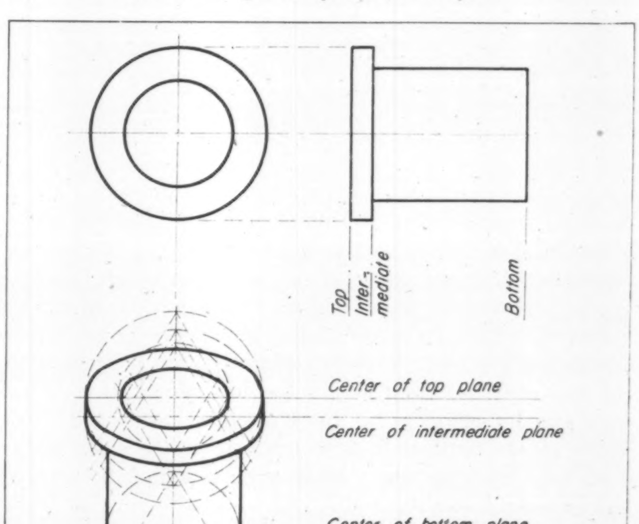
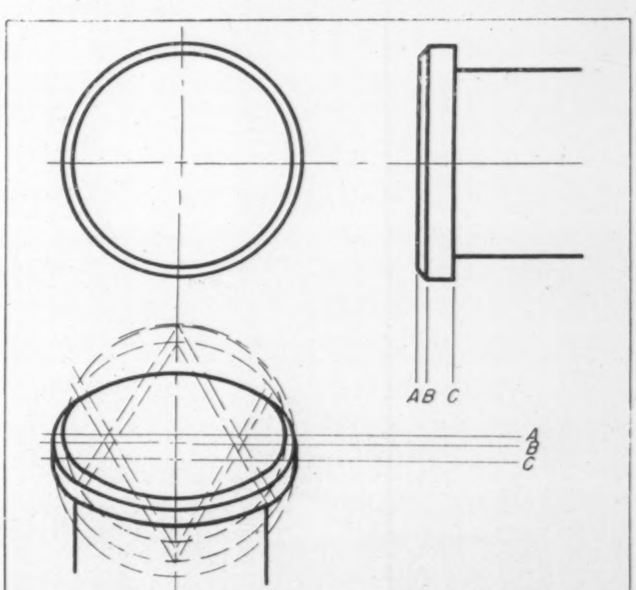


Fig. 9—Drawing of chamfers merely requires proper vertical displacement of standard ellipses drawn to correct sizes



stood without elaboration that the slope on each vane, if continued, would intersect in one solitary point on the center line (see arrows in *Fig.* 11). Thus, instead of having to project 16 points onto an ellipse, it is only necessary to mark *one* point on the center line and use it as "slope center" for quickly drawing the sloping portions of each vane.

Another professional trick makes this an even simpler and quicker proposition: A pin is stuck into the slope-center so that it remains firmly upright. While proceeding from point to point around the periphery, the draftsman can keep one side of the ruler against the pin, which with mechanical precision insures perfect radial alignment. In conjunction with the slope-center method, the intermediate ellipse is used only to indicate the length of the sloping profile. This is the modern solution to the dreaded compound angle work which in the past used to try severely the patience of those who attempted three-dimensional drawing.

Horizontal sections of the vanes are all that remain to be laid out. Again the pin comes in handy. It must now be stuck into the intermediate center toward which all the latter lines converge. Their length is given between the intermediate and the innermost ellipses. In practice the profile layout can therefore be completed without having to project one single point onto the inner ellipses.

With regard to the rounded portions of the vanes which have so far been ignored, the experienced draftsman does not waste time on calculating or developing the required arcs unless there is a pronounced need for great accuracy. In that case he would, of course, resort to projection by diagonals; but as a rule, and this applies in the case of these vanes, it is perfectly adequate to lay in the arcs by judgment. "The smaller the angle the smaller the radius, and the larger the angle the larger the radius" is all that need be remembered. A study of the finished shape view in *Fig.* 5 will provide all the necessary information on this subject.

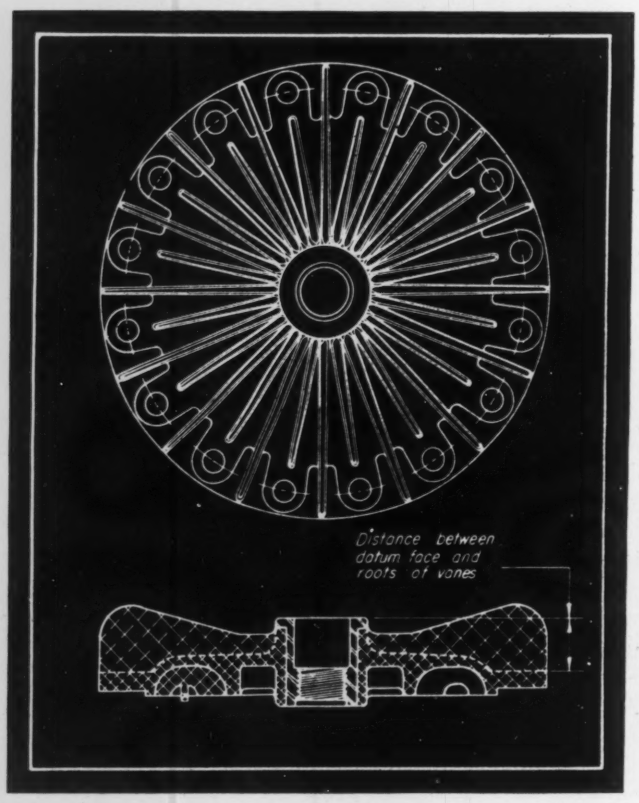


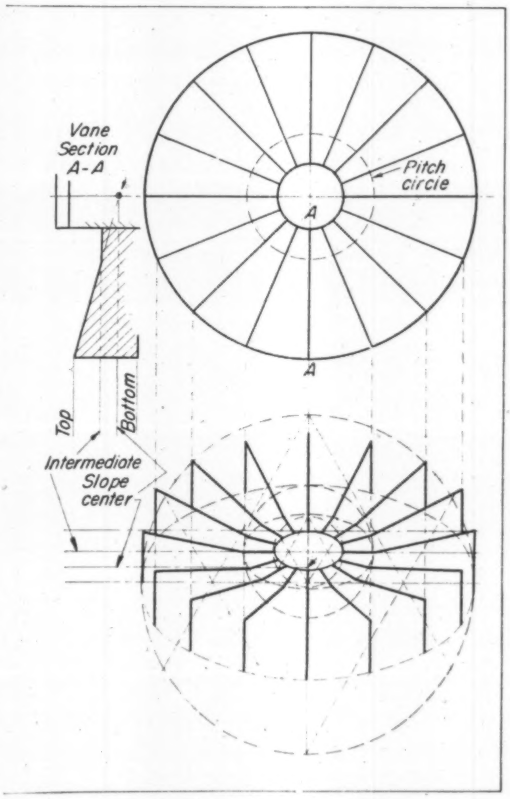
Fig. 10—Orthographic detail of fluid-coupling impeller. Section gives vertical distances which are foreshortened to produce the skeleton view of Fig. 11

Previously, the rule of drawing from the top down has been recommended. Another hint, which is really an expansion of this rule, may now be mentioned. A further saving in time can be effected also by drawing from front to rear. As in the case of lower parts being hidden from view by the top items, so the parts at the front of the assembly will naturally influence the visibility of the rear. With a little thought the draftsman can avoid the disappointment of having to erase some of his work upon finding later that front outlines have to be superimposed. The shape view in *Fig.* 5 helps to illustrate the meaning of the foregoing. The smaller vanes and the self-locking nuts, for example, cannot be drawn in full all round the center because their relative positions interfere with each other's visibility in varying degrees. The sequence of drawing must be planned accordingly. With regard to the smaller vanes it does not seem necessary to describe the projection in detail since, basically, it is but a repetition of drawing the larger ones as shown in *Fig.* 11.

Repeat Features Quickly Drawn

When single items such as rivet heads and nuts have to be depicted repeatedly—and provided they occur either in the same or parallel planes—there is a labor-saving kink which has the additional advantage of clearly showing the visible against the invisible contours. The self-locking nuts in the fluid coupling are in this category. If the draftsman is working on transparent material—which is the most practical for three-dimensional drafting—only one full view of the nut need be drawn on a separate sheet. This can then be traced in the 16 relative positions on the assembly drawing. How to obtain the exact points where the nuts must be located for tracing is already familiar routine, but a simplified method of drawing a pictorial view of a hexagon nut will be well worth examining.

Taking an ordinary nut for instance, the main features are ideally easy for the draftsman as *Fig.* 12 shows, although the mathematician will no doubt want to analyze the chamfer arcs in terms of hyperbolic equations. Drawing a nut on the principles of the standard ellipse and the 45/30 foreshortening starts with the circular top face which is converted into the corresponding ellipse as usual. At the forward end of the minor axis the diagram shows a ringed point which provides the clue to the whole construction. It is the center of a circle into which, surprisingly enough, the shape view fits so nicely that all corner points lie on its circumference. Moreover, its curvature conveniently serves for the five chamfer arcs. Starting with the arcs *A* which merge into the top ellipse, the draftsman sets his compass to this particular radius and completes all the outlines in a way which can be easily gathered from the diagram. After some practice the routine will become automatic and it soon will be found that there is no need to project from the plan view at all, because even the width of the front face on the nut is readily supplied as the distance between the small arc centers in the top ellipse.



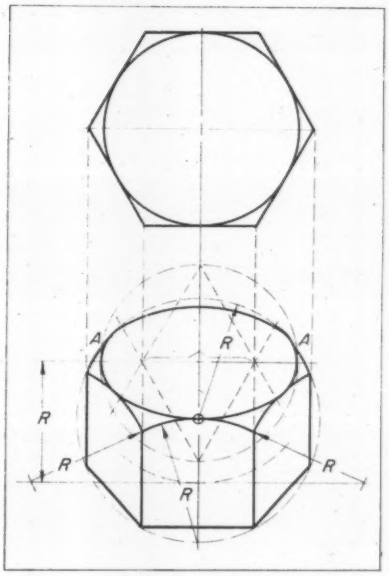


Fig. 12—Construction used in three-dimensional drawing of nut or bolt head. Entire outline fits perfectly into circle

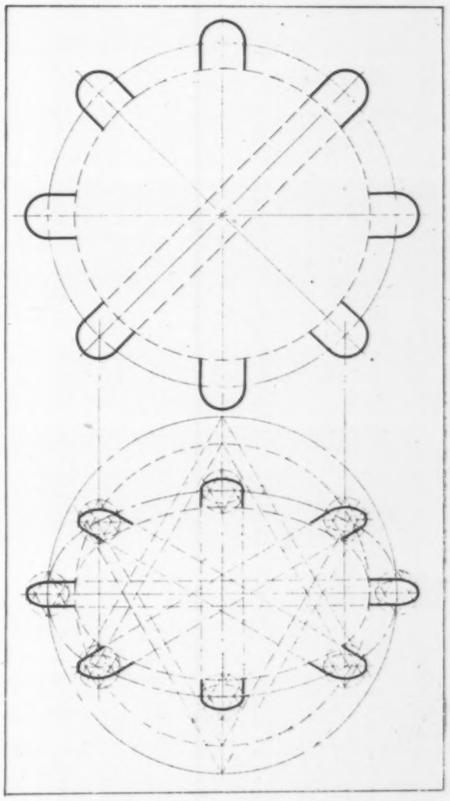


Fig. 11—Skeleton view of fluid-coupling impeller (Fig. 10) shows vane outlines projected from orthographic plan view

Fig. 13—How spacing of bolt pads and their forms on fluid-coupling impeller were laid out in developing Fig. 5

The self-locking nuts in *Fig.* 5 were drawn and traced by employing this short cut. The addition of the domed top and one or two threads of the protruding bolt was made on the master view before tracing. The items immediately below the hexagon nuts are also recurring, but their three-dimensional outline is not the same in all positions and therefore did not lend itself to inclusion on the master view of the nut itself. This is due to the radial disposition of the straight sides which flank the semicircular seatings. *Fig.* 13 will help to clarify the guiding principle for such shape formations. These seatings are diametrically opposite each other and the particular portions of the ellipse which describe the visual curvature of these small platforms can be marked off by means of parallel lines between the corresponding opposite points. Even if the spacing were not so regular or there were an odd number of these seatings, the parallels referred to are still applicable. However, instead of running to opposite points on the circumference of the pitch circle they would then only go to its center where an ellipse of corresponding size must be placed as an aid to construction. It is not difficult to see why this should be so, in fact once explained it becomes self-evident, but it is surprising what headaches "self-evident" things have caused to the uninitiated.

Sufficient has been said about the construction principles and methods regarding three-dimensional assembly drawings to conclude this subject with a brief summary of hints:

1. Always work from the top down and from front to rear
2. Make use of the "slope-center principle" on compound profiles
3. Use master views for recurring items and trace visible outlines only
4. In general, it is well to remember that judicious application of the standard ellipse (*Fig.* 4) together with the correct use of the scale diagram (*Fig.* 3) are capable of solving practically all three-dimensional drawing problems.

In concluding this article on actual drafting practice, it is essential to refer to so-called exploded views. An example is given in *Fig.* 1. This type of drawing is ideal for instruction or service manuals and spare parts lists. Its function is to show every component in its relative position to the whole and in the correct order of assembly. Their preparation does not involve any new principles. After all, exploded views are merely the sum of all detail drawings which belong to the design. Where it is the practice to add to each orthographic drawing a shape view, the required extended or exploded view is, apart from its special arrangement, already complete. The single items need only be traced in correct axial relationship with each other and the work is done. The seventeen items in *Fig.* 1 illustrate the case of unidirectional assembly. They represent part of a wartime gadget which was mass produced in England for the protection of shop windows during the blitz. From the rubber disks to the screw at the top, the assembly is effected on vertical axes.

To include two and three-directional assemblies and discuss the technique of their requisite exploded views lies beyond the compass of the present article. Needless to emphasize, it does not lie outside the scope of the new three-dimensional drafting method. The principles which have been elucidated remain the same throughout the entire field of possible applications.

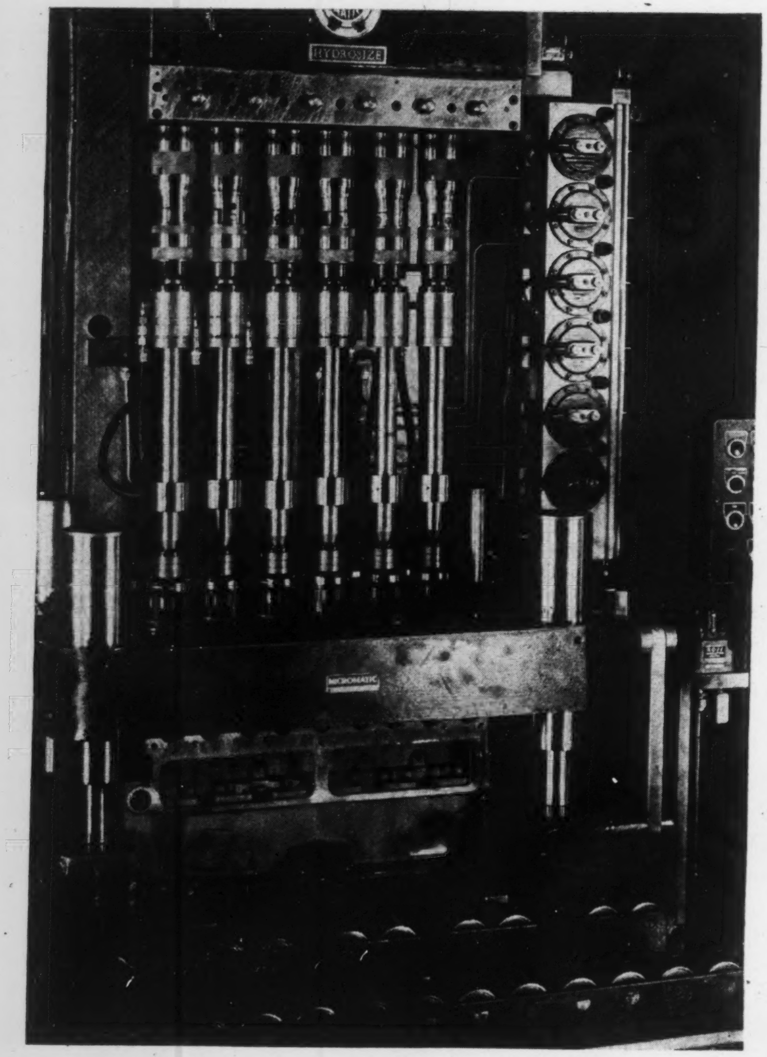


Fig. 1—Left Above—Six-spindle honing machine simultaneously finishes all cylinders in a block, each hone collapsing when reaching size

Air Size-

. . . gages workpiece du

By J. E. Kline
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PERPLEXING design problems are encountered during the development of a gaging device for accurately measuring the size of a workpiece, while relative motion and its resulting vibration occurs between the work surface and the gaging medium. The verity of this has been demonstrated to those who have attempted to combine machining operations with any of the currently recognized precision measuring principles of gaging; the obvious objective of such a combination being improvement in quality-control of the product and lower cost.

Because honing operations require the use of

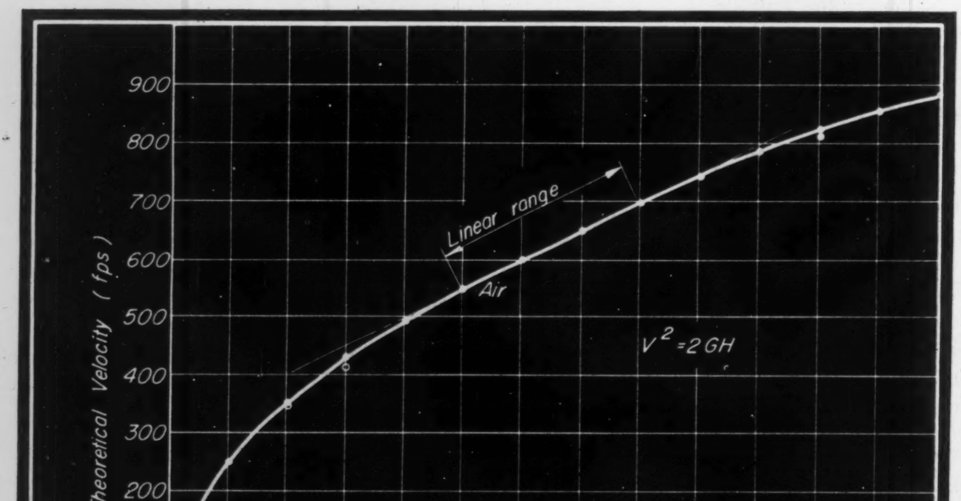


Fig. 2—Left—Pressure-velocity chart indicating the advantage of air for gaging because of its greater velocity at a given pressure

Control

during operation

liquids, commonly called coolants, Micromatic surmised in its original adaptation of fluid gaging to the honing process, that coolant, rather than air, should be used as the gaging medium. Hence the trade-name Hydrosize was derived and, although air is now used, *Fig.* 1, the name has remained.

It is obvious that the use of high pressures or a large volume of the gaging medium would involve an additional problem in coping with spray and consequent operator discomfort. From the chart, *Fig.* 2, it may be seen that the velocity of air, at any given pressure, is many times that of even the lightest liquid. For example, at a pressure of 6 psi the potential velocity of air is about 600 fps whereas that for water is less than 30 fps.

Liquids and gases are subject to the same laws of fluid dynamics. In low-rate flows, however, viscosity of the fluid has a predominating effect

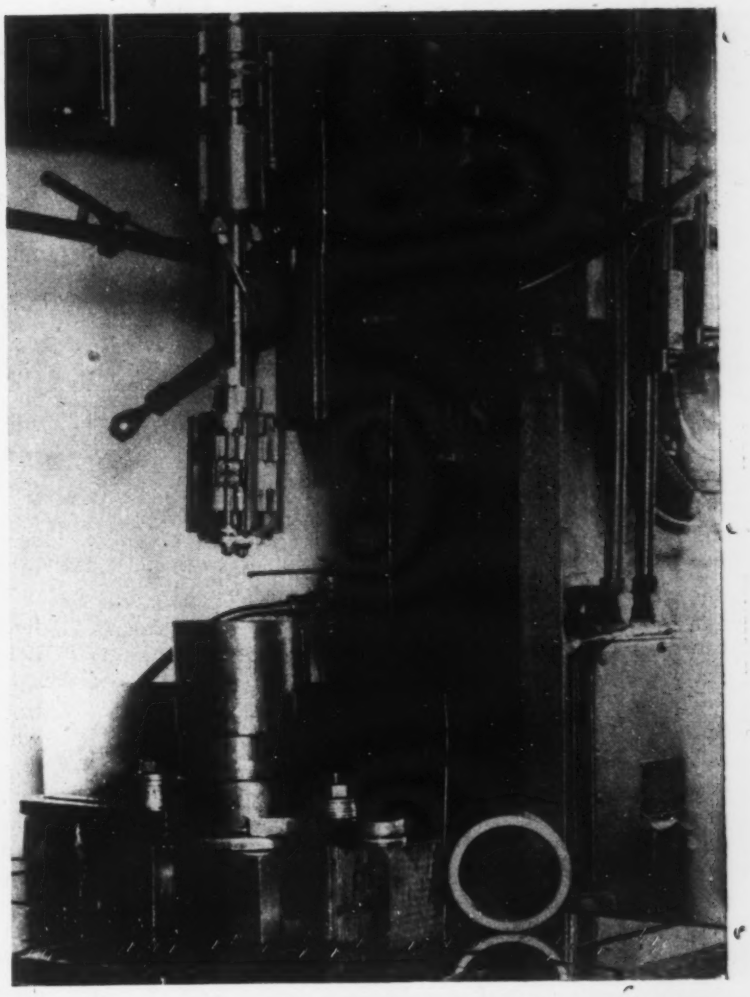


Fig. 3 — Right Above — Early type of fluid-gaged machine, using a portion of coolant for gaging medium

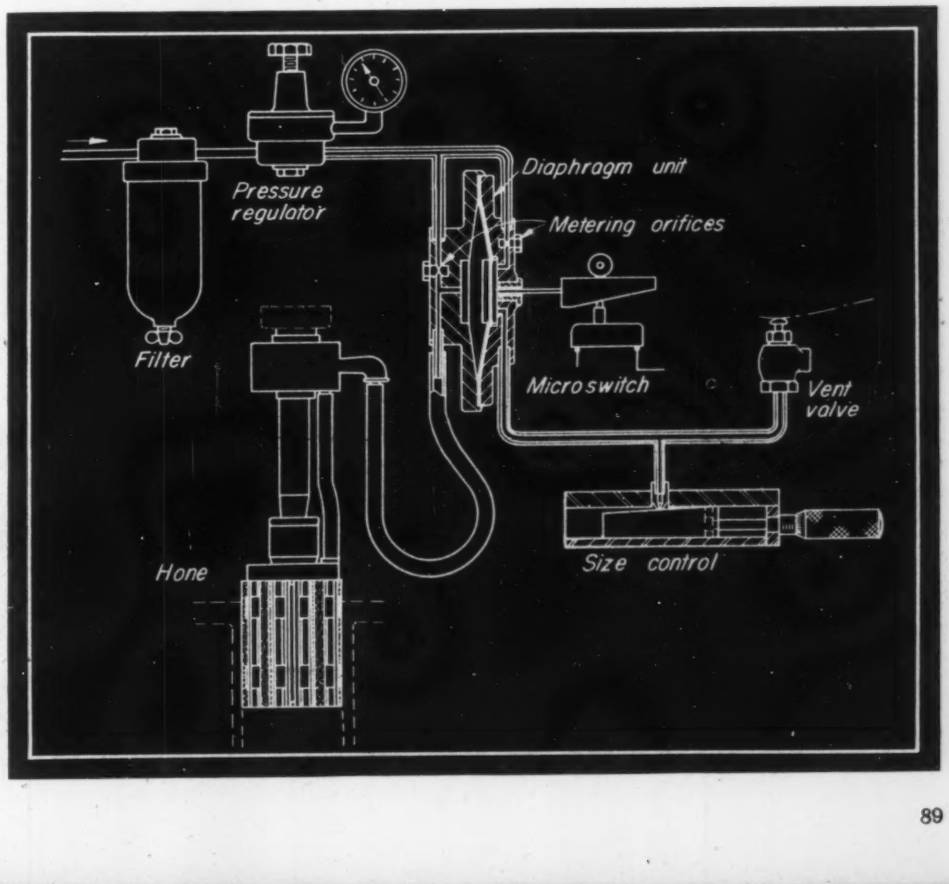


Fig. 4—Right—Opposed-pressure principle is used in control circuit for operation of size-control mechanism

upon its motion, especially where small area orifices are used. High weight-density of the fluid increases its ability to transmit inadvertent pulsations such as may result from machine vibration and rapid changes in rate of flow caused by initial inaccuracy in the workpiece. Principal physical disadvantages in the use of air are due to changes in its humidity and compressibility, resulting from varying barometric and atmospheric temperature conditions. Even though these changes are usually gradual, they are known to affect the flow of air, and it is therefore frequently necessary to adjust conventional air gages to compensate for this. The new self-balancing, opposed-flow principle of control, later described, overcame these disadvantages and thus made the production use of air gaging, during machining operation, reliably stable.

The original fluid-gage tools, shown in *Fig.* 3, used a portion of the coolant as the gaging medium. They were equipped with diametrically-opposed nozzles located in the tool body, centrally along the stone length. Coolant was metered into the gaging circuit and escaped at the gaps between the nozzles and the bore wall of the workpiece. Increase of escape, because of bore enlargement, caused a drop in pressure in the circuit between the input (or metering orifice) and the escape nozzles. The operator manipulated the machine controls to stop the operation at the pressure corresponding to the bore size desired, as indicated on a dial pressure gage. Although somewhat crude, these experiments demonstrated the feasibility of precision gaging of a workpiece during the honing operation.

In order to translate the reaction of the gaging fluid into an impulse to control the operation of the machine, and yet avoid the use of photoelectric tubes, the system of gaging known as the "back-pressure" type was selected. This type is based upon the principle that a uniformly supplied pressure-flow into a circuit will result in a pressure, within the circuit, which is inversely proportional to the rate of flow escaping from the circuit. Except for the manometer, the diaphragm is perhaps the most sensitive of fluid pressure devices. Usually a diaphragm is used with a spring on one side, opposing fluid pressure on the other.

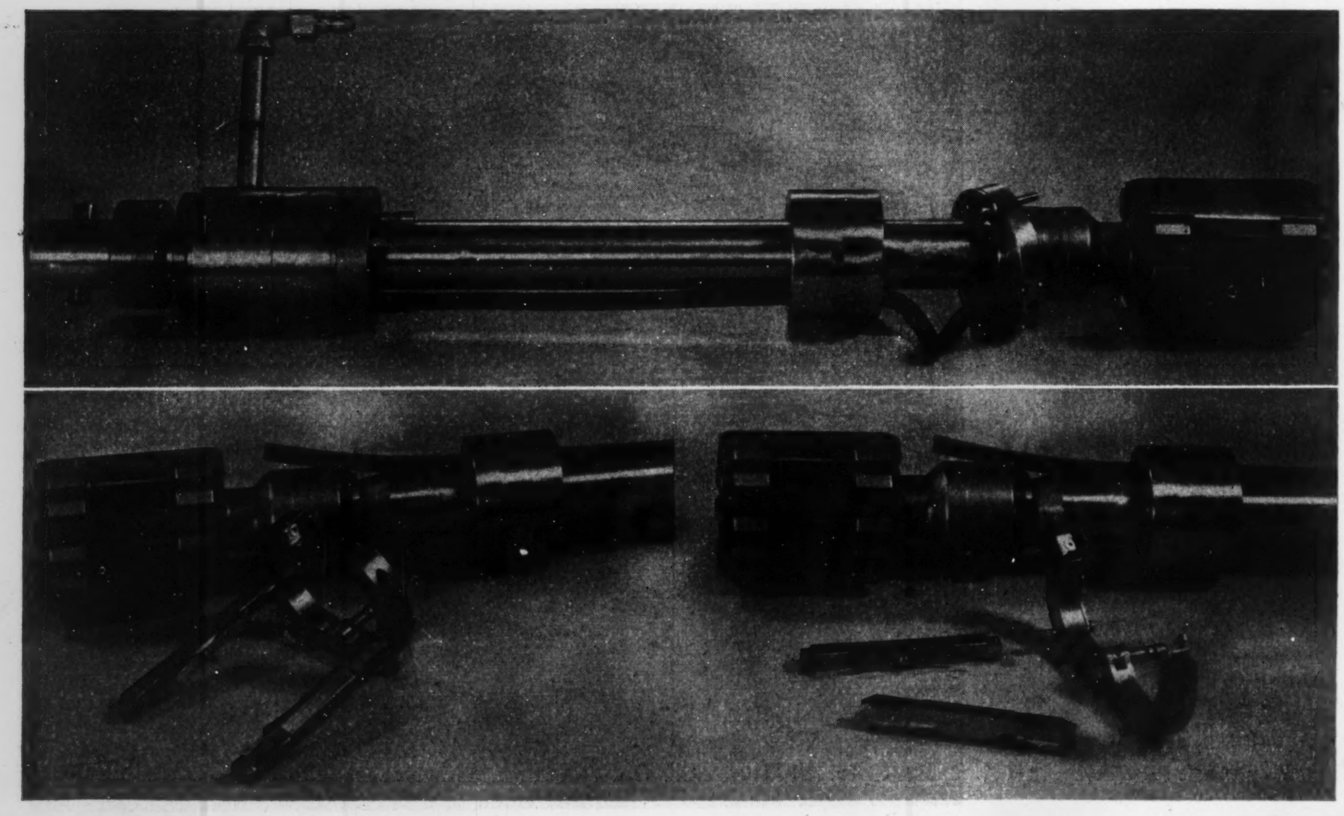
Circuit Utilizes Opposed-Pressure Principle

In *Fig.* 4 is illustrated the fluid circuit currently used in the control unit, incorporating an opposed fluid-pressure principle. Its novelty resides in its facility of adjustment and the fact that the size-control mechanism can readily be positioned remote from the tool it controls. The flow of air from the regulator is split and is metered separately into the "size control" and the "hone" branches of the circuit.

The diaphragm of the switch unit is subjected to differential pressures on its opposite sides throughout the honing operation. At the start of the cycle, only the hone side of the diaphragm is under pressure because the control side is vented to atmosphere through a vent valve which is open when the machine is at rest. This is done to reset the electric controls and limit switches after their previous function, and to put the diaphragm in its maximum position of unbalance so that a consistent amount of its travel is required to trip the microswitch.

After the tools have entered the succeeding work bore, this valve closes and pressure in the control circuit rapidly builds up to its preset value which is still less than that in the hone circuit, providing the work bore diameter is undersized. The "peak" or static pressure in the control chamber of the diaphragm is predicated upon the rate of

Fig. 5—Gaging assembly consists of hinged ring carrying a nozzle, spring-mounted anvil and two gage bars



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escape of air at the remote adjustable size control jet which is manually preset. The reacting pressure, on the hone side of the diaphragm, is governed by the rate of escape at the nozzles of the honing tool.

Enlargement of the bore, by honing, increases the rate of escape at the hone nozzles with a resulting pressure decrease on the hone side of the diaphragm. Movement of the diaphragm occurs when that pressure has dropped to a value below that of the control side. This movement trips a sensitive microswitch which electrically controls the expansion mechanism of the hone and the machine cycle.

In order to permit the diaphragm action to differentiate between an inadvertent pressure pulsation and a bonafide pressure drop, the microswitch operating mechanism is permanently adjusted so as to require considerable diaphragm movement before the microswitch is tripped. To do this, use of a shallow-angle wedge offered the simplest solution. This wedge is arranged to be pulled away from a depressed microswitch plunger, upon arrival at desired bore size, thereby minimizing the ill effects of friction.

One-Ounce Pressure Actuates Switch

Effective area of the diaphragm is approximately 12 square inches and the pull of the wedge required to trip the microswitch is less than one ounce. The diaphragm material is a 0.015-inch thick specially plasticized neoprene which is relatively unaffected by oil or normal temperature change. These factors combine to make the assembly capable of responding to a pressure differential of less than 0.1-inch of water, irrespective of the primary air pressure used.

The fact that the diaphragm is air actuated in both directions of its traverse is important. Its motion is predicated solely upon the pressure differential on its opposite sides and, inasmuch as these respective pressures are subject to the same atmospheric change, they are both similarly affected. Thus the pressure differential, and hence the response, remains the same. On dry or frosty cold days and arid or wet warm ones, no difference has been noted in the consistency of its response, even at shop temperatures of 60 to 100 F the unit functions uniformly well. Because of these experiences, it is evident that the differential pressure principle is as reliable as any other means.

A later revision in the nozzle arrangement of the tool was made as shown in *Fig.* 5 to facilitate the replacement of wornout stone. In this design, a hinged caliper-like ring carries a single nozzle; a pair of diametrically opposed Carboloy-insert gage bars lightly contact the bore and govern the nozzle gap in accord with the changes in the work bore diameter. This gaging assembly can be readily moved out of the way to change stones or may be easily replaced, should that become necessary, without removal of the tool from the machine.

In this type of construction, the escaping air is not distributed over the surface of the work bore, but instead is projected against a spring-mounted "anvil" opposing the nozzle in a shrouded chamber. Thus high or low velocity air may be used, or changes in the relative motion between the honing tool and the workpiece may be made without affecting the accuracy of the gaging function.

The spring mounted anvil may be depressed by the nozzle in the event that an excessively undersized bore is entered by the tool. This practice is also used in instances where considerable increase in the diameter of the bore is to be accomplished by the hone. In so doing, the gaging air flow is stopped-off by the anvil until a "few-thousandths" before the desired bore size is reached. The gaging gap is thus very slight in amount and the resulting back-pressure, at final size, is all the more precise.

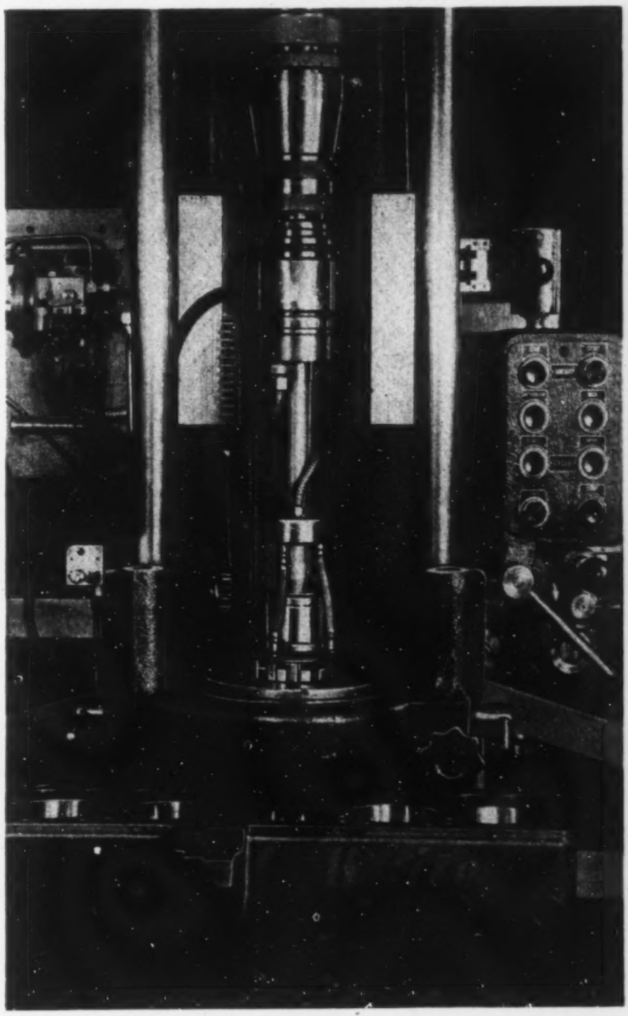

Fig. 6—Single- spindle machine in which gaging control automatically indexes the fixture, transferring operations through successive bores

This control is now being used on single and multiple-spindle honing machines, *Figs.* 1 and 6, and is mass producing automotive cylinders repetitively, within 0.0005-inch total tolerance for size. *Fig.* 6 illustrates a single spindle machine using an automatically indexed fixture which transfers the honing operation through successive bores in a block and produces a completed six-cylinder block in about two minutes. *Fig.* 1 pictures a six-spindle machine with which 0.003 to 0.004-inch of stock is honed simultaneously from all six cylinders of the block in an average operating time of thirty seconds. Either machine sizes the bores automatically; the operator's function being limited to loading and unloading the fixture and the starting of the machine.

Controlling the operation from the part produced is the new vein in manufacturing technique. The combining of modern size inspection instruments with modern machine tool equipment offers a broad new field for manufacturers; and a great opportunity for translating wasteful labor dollars into profitable capital investment.

The Ram-Jet Engine

Severe operating conditions intensify design problems

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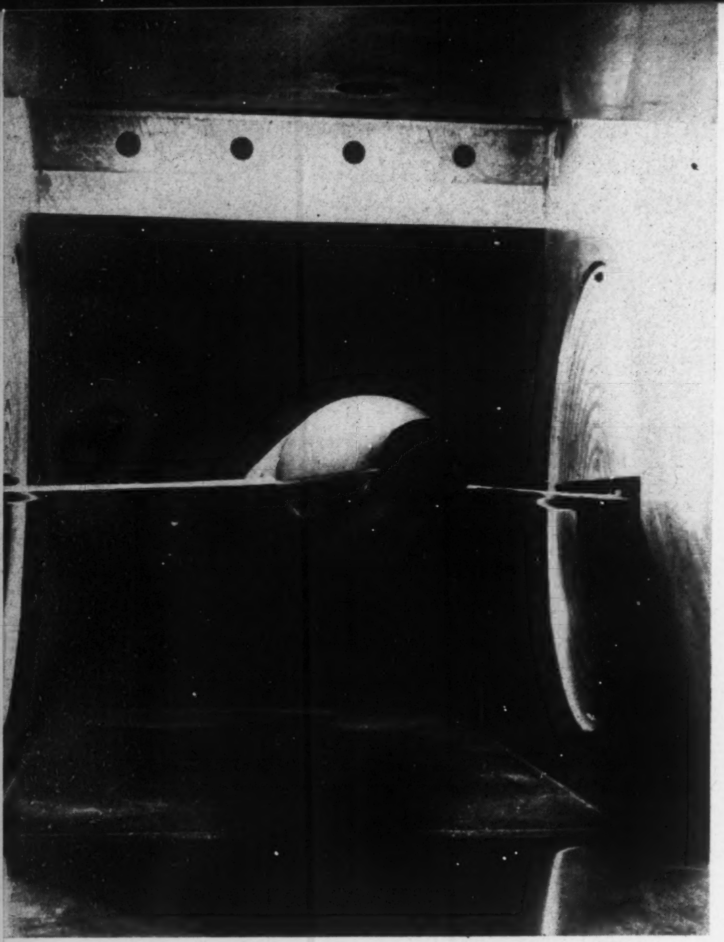
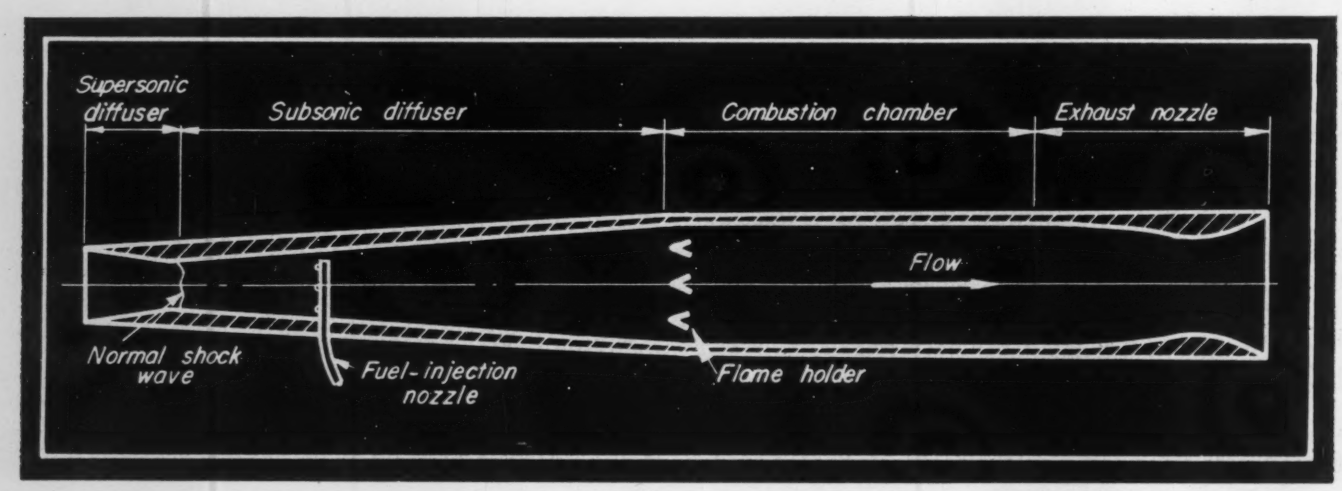


Fig. 1—Above—View, looking downstream, of a supersonic ram-jet model mounted in the test section of a supersonic wind tunnel

HIGH-SPEED FLIGHT and the attempts being made to break through the barrier encountered by aircraft at sonic speeds (about 760 miles per hour at sea level) have focused attention on the ram jet, a test model of which is seen in *Fig.* 1, as a possible power plant for high-speed aircraft. The ram-jet system was first proposed several decades ago as the "aero-thermodynamic duct," conveniently shortened to "athodyd." Because the speeds at which aircraft were flying at that time were too low to make the engine practicable, the ram jet remained only a proposed engine design and no experimental investigation of the performance potentialities of this engine was undertaken. With aircraft already flying at speeds in excess of 600 miles per hour, however, interest in the ram jet as a power plant has been revived.

With the exception of the rocket, the ram jet is probably the simplest conceivable engine for the propulsion of aircraft. A schematic diagram of a conventional design is illustrated in *Fig.* 2. The engine has no moving parts and consists essentially of three elements: Diffuser, combustion chamber, and exhaust nozzle. As the engine moves through the atmosphere, a quantity of air is entrapped and flows through the engine. The diffuser acts to decrease the velocity of this air and convert its velocity energy into pressure energy. A burner, similar in many respects to ordinary commercial oil or gas burners, introduces and mixes the fuel with the air. The mixture is then ignited and burned at approximately constant pressure. The hot products of combustion expand through the exit nozzle

Fig. 2—Below—Schematic longitudinal cross-section of a ram-jet engine showing effective areas



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down to atmospheric pressure, *Fig.* 3, propelling the engine forward.

The successful operation of a ram jet depends on the proper shaping of the duct. The relation between the diffuser, combustion-chamber, and exit-nozzle areas is dictated by the conditions at which the engine is expected to operate. In most current engines, a velocity between 150 and 200 feet per second is desirable at the combustion-chamber inlet. The diffuser must therefore be shaped to decelerate the air from free-stream velocity to a greatly reduced value as efficiently as possible and with a minimum loss in total pressure (total pressure is the sum of static and dynamic pressures). This is easily accomplished at subsonic speeds but becomes increasingly difficult at supersonic airspeeds. The combustion chamber and burner design must give efficient combustion over a wide range of fuel-air ratios and mass air flows. Finally, the exit nozzle must be shaped to give efficient expansion of the combustion products from combustion-chamber pressure to atmospheric pressure with a minimum total-pressure loss.

Engine Will Operate Only In Earth's Atmosphere

As with turbojet engines, the ram jet will operate only within the earth's atmosphere because oxygen is required to support the combustion of the fuel. A further disadvantage, peculiar only to the ram jet, is that the operation of the engine depends on forward velocity. At zero airspeed no useful thrust is obtained. However, as the speed at which the ram jet moves through the air increases, the efficiency of its operation improves. This improvement is due to the greater ratio between the combustion-chamber pressure and the ambient air pressure as the airspeed increases.

Output of a jet engine is expressed in pounds of thrust. The thrust delivered by the ram jet is given by the change in the momentum of the air flowing through the engine:

$$\text{Thrust} = \text{mass flow of air} \times (\text{jet velocity} - \text{flight velocity})$$

An increase in altitude causes a decrease in thrust because the mass of air flowing through the engine is reduced. Altitude, however, has no effect on the overall efficiency. Both the thrust and the over-all efficiency increase at a very rapid rate with increases in flight velocity. Enlarging the nozzle-exit area increases the thrust by allowing a greater air flow through the engine. The effect of the ratio of final gas temperature to inlet air temperature on thrust and over-all efficiency is especially important. An increase in this ratio results in an increase in thrust but a decrease in over-all efficiency. As would be expected, the over-all efficiency is a direct function of the burner combustion efficiency. For maximum thrust, a ram jet of a given design and geometry should be flown at high speeds and the air flowing

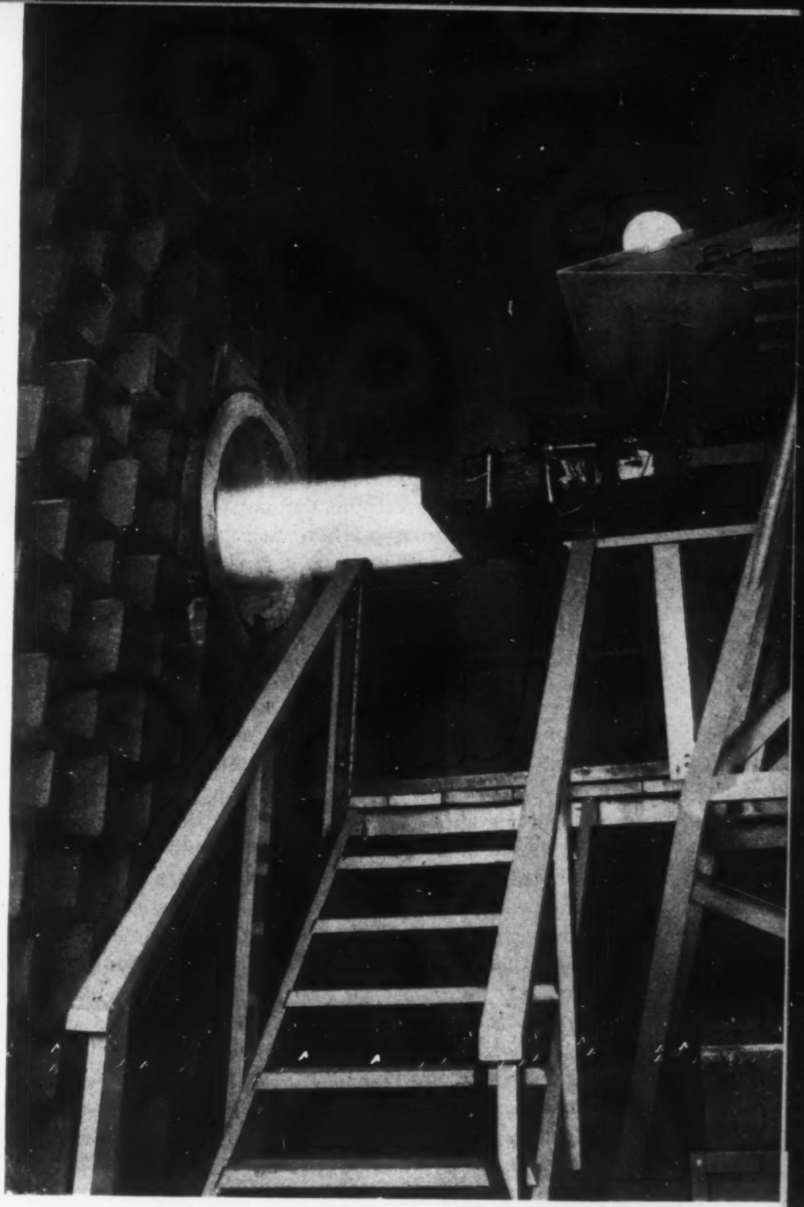
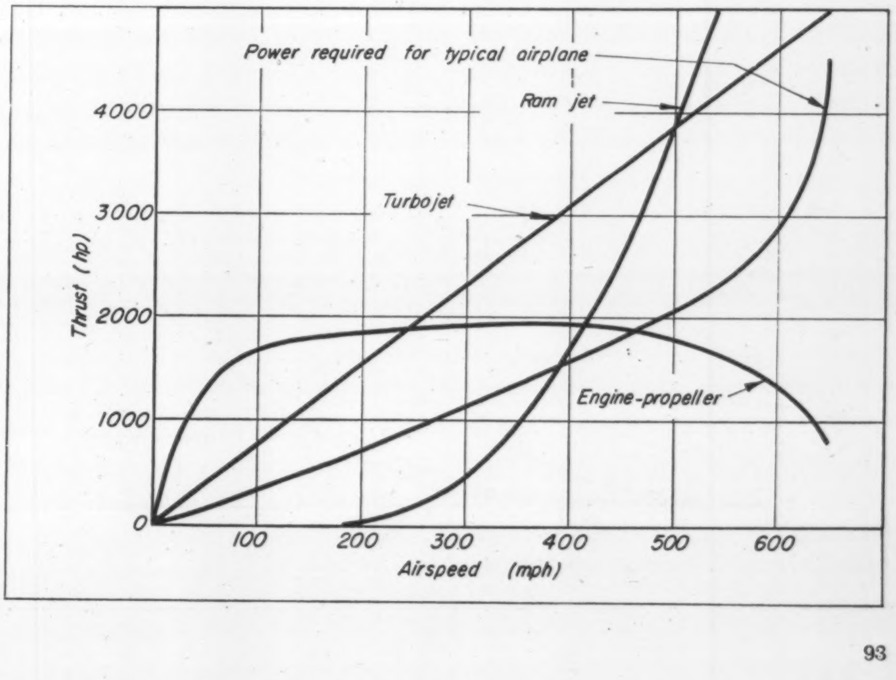


Fig. 3—Above—Test run of experimental rectangular-exhaust nozzle. Gas temperature approaches 3000 F

Fig. 4—Below—Power output at sea level of basic types of engines compared with demand of typical airplane



through the engine should be heated to high final temperatures.

Comparison of a current 2200-horsepower reciprocating engine, a current 3000-pound thrust turbojet engine, and a ram jet as power plants for a typical high-speed airplane is shown in *Fig.* 4. The trends of the power required to overcome the sea-level drag of the airplane and the sea-level thrust horsepower of each engine are presented as a function of airspeed. The ram jet for which the data are given is the largest that could be installed in the airplane and has a 45-inch diameter combustion chamber. Its performance is based on conservative theoretical calculations. The comparison between ram-jet power and the power required to overcome the airplane drag has been extended to 1400 miles per hour in *Fig.* 5. The variation in ram-jet over-all efficiency is also shown. The portion of *Fig.* 5 enclosed by dashed lines has been shown in *Fig.* 4 with an expanded scale.

The reciprocating-engine-propeller combination delivers a fairly constant output horsepower to approximately 500 miles per hour. Then, because the propeller efficiency drops with further increases in airspeed, the output horsepower of the combination also decreases. The turbojet engine, on the other hand, delivers approximately constant thrust at all airspeeds. Thus the horsepower output of the turbojet engine increases linearly with airspeed. The thrust horsepower of a ram jet increases as the cube of the airspeed and climbs rapidly as the airspeed is increased. The break in the curve of power required to overcome the airplane drag occurs in the transonic speed range.

Each engine can be used to power the airplane at speeds at which the engine horsepower is equal to or greater than the airplane-drag horsepower. Current reciprocating-engine-propeller combinations can therefore be used to only about 500 miles per hour. The turbo-jet engine can be used to about 700 miles per hour, and has therefore already been used to almost its maximum speed. With certain modifications, the turbojet engine can be used to even higher air-speeds. The ram jet, however, can be used only above 350 miles per hour. Thrust of the ram jet varies with airspeed, and also with altitude, in much the same manner as the airplane drag, and above 350 miles per hour the ram jet delivers a margin of thrust over drag. Moreover, as the airspeed is increased the over-all efficiency of the ram jet increases until at 1400 miles per hour it approaches the efficiency of current reciprocating-engine-propeller combinations in their usual operating range.

The low efficiency of the ram jet at speeds at which other engines can be employed may be balanced by its inherent simplicity. However, the ram jet requires an auxiliary power plant or assisted take-off to the airspeed at which its thrust is sufficient to overcome the aircraft drag.

Many Problems Remain To Be Solved

There are many problems associated with the development of a successful flight ram jet. The metallurgical problem is especially serious at the present time. The exhaust-gas temperatures reach 3000 F and even higher temperatures are desired. Although the internal pressure reaches only 7.6 atmospheres at 1400 miles per hour, at 3000 miles per hour theoretically it would be 160 atmospheres. The design of a duct to withstand these pressures and temperatures and yet be of light construction is extremely difficult. Current experimental engines are being made of stainless steels and Inconel and are provided with external liquid cooling. Ceramic is also being investigated as a possible material.

Because ram jets are now designed with constant geometry, they attain peak performance at only the design operating condition. In order to permit effective operation off the design point, an adjustable-area inlet diffuser and an adjustable-area exit nozzle are desirable. These present difficult practical problems in design. A control for metering the fuel flow to the burner must be based on the final gas temperature. As yet there is no effective means of easily determining the temperature of a high-velocity high-temperature gas stream. The combustion chamber must be as versatile as possible. High combustion efficiency over a wide range of fuel-air ratios and velocities are desirable in as short a combustion chamber as possible. Although the current fuel used is gasoline, the burner may be required to handle some of the heavier fuel oils as well.

Despite developments yet to be made, the ram jet may already be considered the most powerful engine available (with the exception of the rocket) for the propulsion of aircraft at high speeds. Continued research and study should provide solutions to the problems that yet exist and improve the performance of current ram-jet engines.

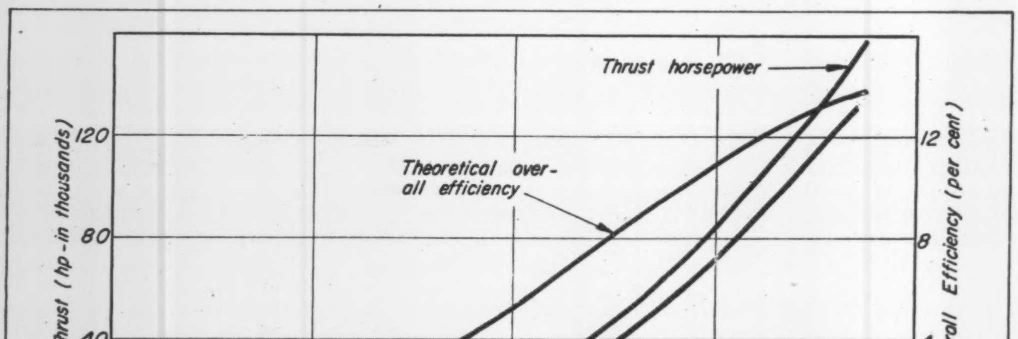
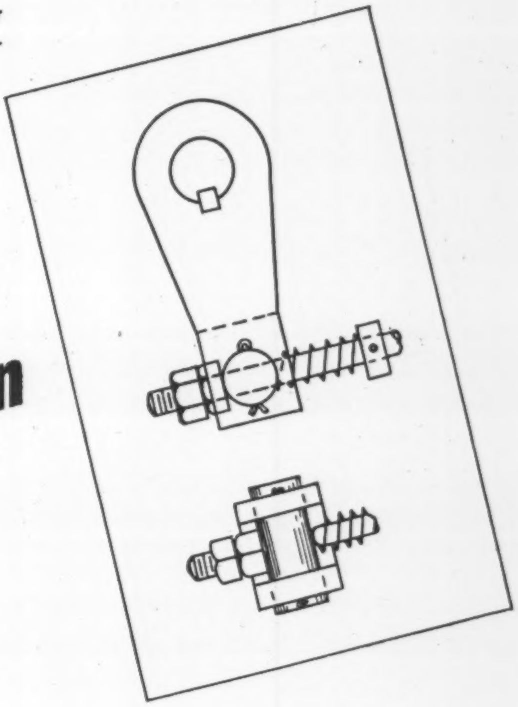


Fig. 5—Performance curves of ram-jet engine at sea level

Fig. 1—Spring attachment on lever is simple overload release for reciprocating mechanism



Overload Devices for Machine Protection

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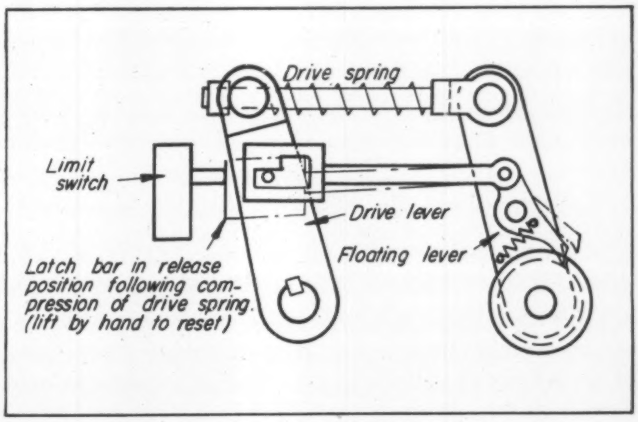
STUDIES of recent machinery designs reveal that increasing attention is being given to means for providing automatic interruption of the drive in the event of a jam or other abnormal operating condition within the machine. Recognizing the fact that the momentary overload capacity of the usual drive is generally several times that of critical machine members or of fragile articles being processed, careful designers are forestalling serious damage by limiting the maximum available drive torque to that actually required for running.

The value of such protection is dramatically illustrated by recent experience with several large, special-purpose packaging machines. These were down over 15 per cent of the time as the result of repeated failures of some minor part or function that wound up as a broken cam or a major failure deep in inaccessible parts of the machine. Despite general mechanical improvement in the machine over a period of years, this situation persisted until the decision was finally reached to incorporate in the drive a slip clutch that would transmit no more than a certain preset torque to the main cam shaft. The cost of these clutches was paid for in three weeks, and downtime dropped from 15 to 5 per cent.

Fig. 2—Overload release for ratchet has latch bar and limit switch to stop drive


Drive spring
Limit switch
Drive lever
Floating lever
Latch bar in release position following compression of drive spring (lift by hand to reset)

Much as standard machines need protection to prevent needlessly high maintenance costs, new experimental machines need it even more. Time after time during start-up of a new special-purpose machine, some minor interference produces a major smash-up no matter how carefully the machine is inched ahead by hand when tests begin. The inevitable consequence is that development costs skyrocket and delivery schedules are badly upset.

Protection Should Be Routine Design

It is somewhat disturbing to note the difference in this respect between conventional mechanical and electrical design. The electrical designer installs a fuse or circuit breaker as a routine safeguard between electrical apparatus and the line. Within the apparatus itself he inserts additional fuses, carefully protecting each subunit to the best of his ability. This procedure is far from routine with machine designers, perhaps because the problem is somewhat new. A few decades ago the standard lineshaft and flat-belt drive offered a fair amount of machine protection by slipping under overload. Since then there has been a conversion to individual motor drive; furthermore, speeds have gone up and machines have become increasingly complicated. The mechanical designer must learn to appreciate this situation.

For an individual motor drive, the usual protective devices include a fuse box to safeguard the distribution lines, and an adjustable thermal-overload relay, which protects the motor from overheating but provides a liberal margin for starting. In addition to the motor, the individual drive

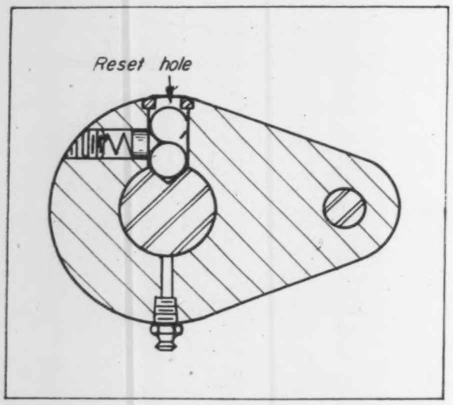


Fig. 3 Left—Reset type of ball detent protects drive in both directions of operation

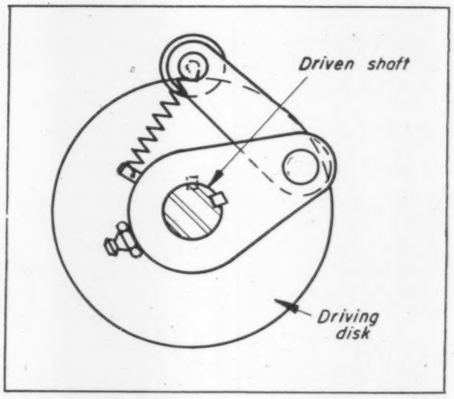


Fig. 4 Right—Spring loaded detent coupling is useful for either reciprocating or rotating types of drives

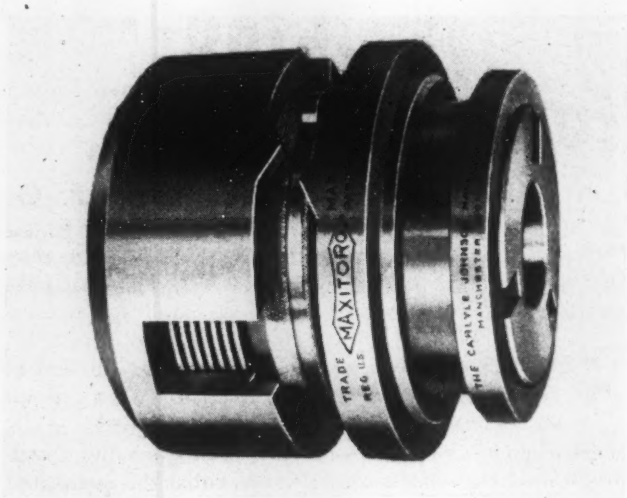


Fig. 5—Carlyle-Johnson automatic releasing friction coupling employs cam to disengage clutch

generally involves gearing and a connection to the load through a flexible coupling, chain, or V-belt—all parts conservatively rated for long life. Thus there is virtually no mechanical protection for the driven machine unless it is massive compared with the motor. Furthermore, it must be remembered that even if the thermal overload or fuse does go out, there still remains the kinetic energy of the motor armature. To illustrate the magnitude of the forces involved, a 1700 *g* peripheral deceleration rate is required to stop in 1-inch a 12-inch armature moving at 1800 rpm. In comparison, 3 *g* is required for the motor to accelerate from zero to top speed in one second.

Until recently, the shear-pin was the standard engineering answer when the need for such protection was realized. It has the merits of low cost and simplicity, but also serious disadvantages, principal among these being poor accuracy and the requirement that it be replaced after functioning. Now, belatedly, realization is growing of the importance of the problem and the need for thorough protection, and there is at last available a diversified selection of torque-limiting devices.

In the field of reciprocating drives the simplest mechanical release is a preloaded lever which pushes a spring in the manner shown in *Fig.* 1. This is always advantageous, save in the cases where it is preferred that the entire machine be stalled as a unit in order to avoid clashes. The spring-loaded drive has the added advantage that backlash can be overcome by putting a screw stop in the front of the mechanism and forcing the spring to compress slightly at the end of each stroke. *Fig.* 2 shows an arrangement giving immediate release of a ratchet feed and at the same time stopping the motor. It is similar to the release of *Fig.* 1, but provides in addition a latch bar which drops down by gravity if the floating lever and pawl resist movement. The limit switch is struck by the dropped latch bar on the return stroke of the drive lever.

Ball Detent Protects Both Ways

A variation of the direct spring-loaded lever or crank drive is a ball-detent engagement, which has the advantage of protecting in both directions. As seen in *Fig.* 3, the ball detent can be arranged for permanent release where this is desirable for safety reasons. Should this be done, however, the designer must provide ready accessibility for reset.

Another possibility along these lines is the aforementioned shear-pin, which offers compactness and low cost but also must be accessible. For instance, the standard taper-pin fastening of a crank to a shaft can be converted readily into a shear pin as discussed in a previous article.[*] Power sources like air or hydraulic cylinders have the same effective action as spring-loaded drives. A solenoid can also be used in this manner provided it is fused against overheating.

Rotary drives present a somewhat different problem than do oscillating or reciprocating drives. Obviously a spring release is impractical because this would simply wind up until it broke. The shear-pin can be used, but when a simple mechanical device is indicated, preference is usually given to friction and detent releases as discussed in the previous article. In general, the shear-pin is to be accepted only on applications such as an outboard motor propeller where a torque sufficient to cause damage must be at least double the normal running torque. The reason for this is that the actual strength of any given shear-pin is always uncertain and depends on the material, dimensions, design, surface finish, corrosive media encountered, and previous stress history (fatigue). Should the load be of a pulsating, shock, or fast-starting character, the ratio often must be increased from 2:1 to 3:1 or 4:1.

Another objection to the shear-pin stems from a quirk of human nature. If shear-pin breakage is frequent even though proper, as in the case of considerable tramp iron

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[*] "Mechanical Torque-Limiting Devices", MACHINE DESIGN, May, 1946.

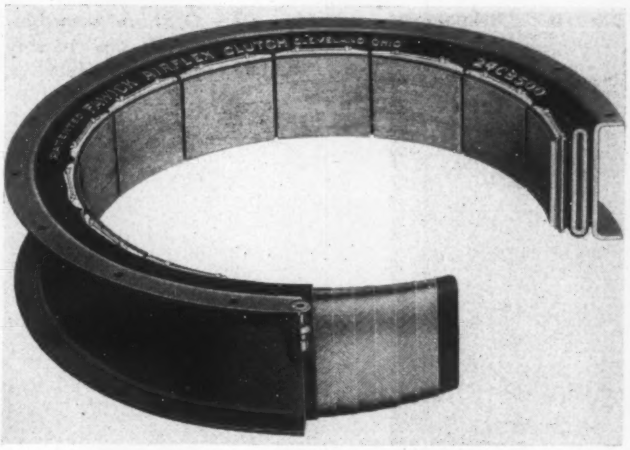
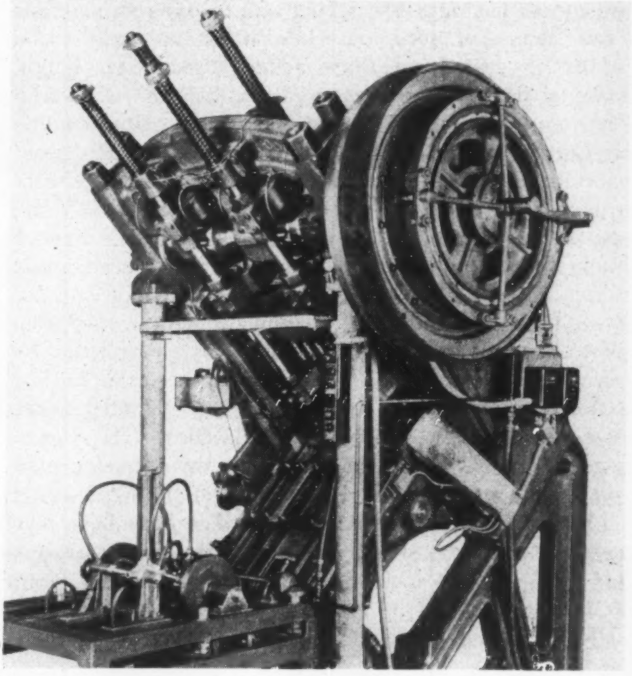


Fig. 6 Above—Fawick pneumatic clutch. Release point is controlled by varying the air pressure

Fig. 7—Below—Air clutch, of the type illustrated in Fig. 6, mounted on flywheel of a press to limit torque transmitted, thus preventing damage to dies and crankshaft



in a coal feeder, often there will appear a heavy steel bolt in the place of the shear-pin. Where, notwithstanding, low cost and compactness strongly suggest the shear-pin, its reliability on a nonpulsating load can be considerably improved by the use of multiple pins. With careful design and manufacture it is possible to build a multiple-pin coupling (perhaps eight pins) which will show no more than 10 per cent variation from design shear torque under favorable running conditions.

Have Adjustability and Reset Features

Spring-loaded detent clutches are similar to the shear-pin in most of their characteristics, but offer adjustability, high accuracy (typically 5 per cent) and easy reset, which may be either manual or automatic. Their limitations are cost (which sometimes will be as high as the drive motor itself) and size, which generally preclude use in applications over 100 horsepower. *Fig.* 4 illustrates a coupling which is useful for either reciprocating or rotary drives and which is readily applied to small mechanisms. To the writer's knowledge it is not commercially available, although there are many commercial equivalents as discussed in the previous article, "Mechanical Torque-Limiting Devices".

Another interesting variation is applicable to worm drives. If the worm gear refuses to budge, provision is made for the worm to screw itself ahead against a spring until it strikes an electric stop switch or releases itself through a dog clutch arrangement.

For the majority of simple rotary drives in which no timing relationship is necessary, the friction release will be found preferable. Cost is generally somewhat less than the spring-loaded detent release, and the slip characteristic can be used to advantage in cushioning starting, shock, or pulsating loads. Replacement or reset is not required, and the clutch can be placed near the load with minimum consideration given to accessibility. Accuracy is not as high as the spring detent, being of the order of 20 per cent variation from the original setting, but is usually adequate because the requirements of the machine itself often vary more than 20 per cent due to such conditions as ordinary changes in work loads, inadequate lubrication or congealed grease on a cold morning's start-up. In any event, the engineer should instruct operating personnel to test any adjustable release device regularly;

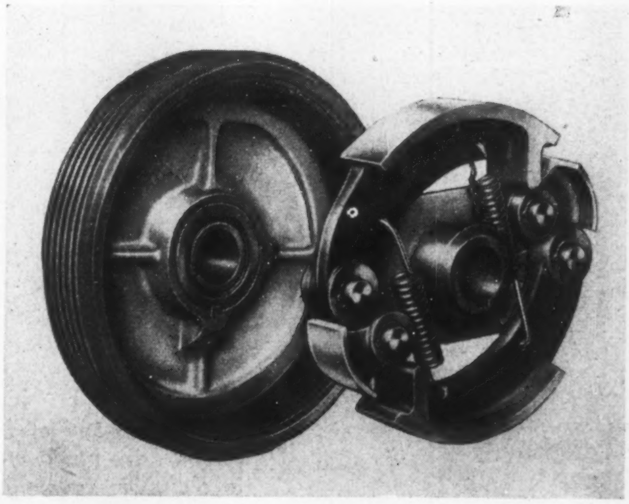


Fig. 8 Left—Salsbury centrifugal coupling of this type may be used for overload or safety release

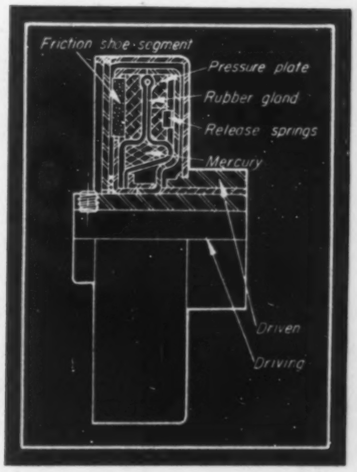


Fig. 9 Right — Mercury clutch of axial displacement type

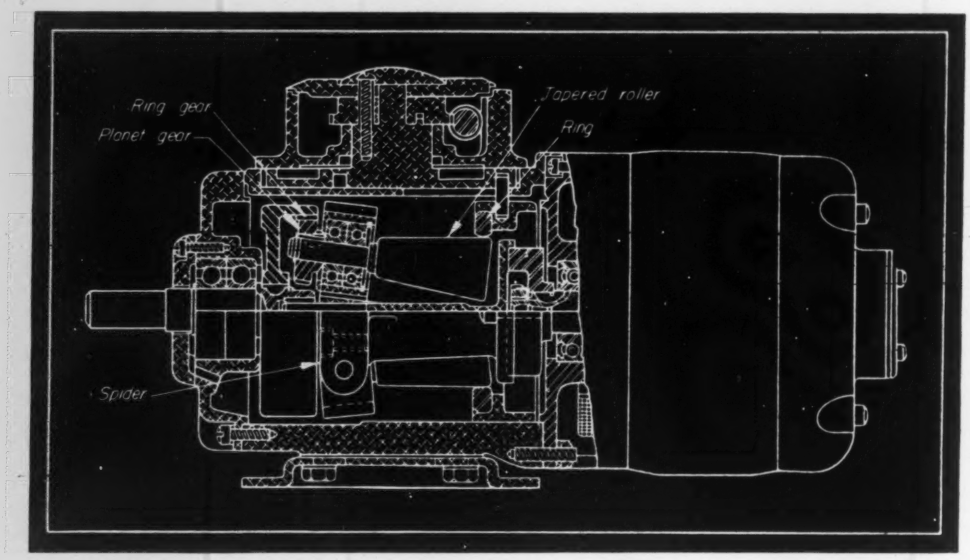


Fig. 10 — Graham variable-speed drive will slip reliably for short periods

the adjustment is loosened until the drive starts to slip and then is retightened slightly.

Simplest of such slip devices is the flat-belt drive (fixed-center type only). However, the variable condition of belts in usual industrial practice and the effect upon such a belt if it does slip strongly suggest that some other slip protection be provided where possible. Engineers sometimes are tempted to rely on V-belt slippage for protection. This may be permissible when using leather belts or highly polished plastics pulleys, but it will be found that the V-belt can jam and is not suitable for over-load protection.

Round springs or leather belts are not subject to the foregoing limitations. Because of the small horsepower demands to which such belts are generally applied, they are very effective slip devices, an example being the spring belt in the home movie film windup.

While analyzing these devices the engineer will be interested to check the standard friction clutch and cut-off couplings. Unfortunately, because the conventional industrial clutch is provided with a high mechanical-advantage cam, screw, or roller pressure device, it is to all intent and purpose a solid block of steel when properly adjusted. On the other hand, if adjusted light enough to slip on a moderate overload, it wears out of adjustment quickly because of the small internal resilience.

Accordingly, it is seen that a friction clutch intended for overload-release service must be provided with pressure means having a low spring rate in order to maintain a fair degree of accuracy while taking up wear. Coil springs or centrifugal force acting directly on bands, blocks, or flat plates offer a simple answer. Several variations were described in the previous article. *Fig.* 5 shows the Carlyle-Johnson clutch, in which relative motion of the clutch driven and driving members causes cam teeth to disengage the clutch as soon as it starts to slip. This type is also made by Conway. *Fig.* 6 illustrates a Fawick clutch, which resembles an automobile tire placed inside a drive cup. This clutch features smooth action and the possibility of cyclic torque variation through external control of air pressure. Point of release is controllable, by varying the air pressure. *Fig.* 7 illustrates an application of this type of clutch. An equivalent air-actuated clutch has been introduced recently by Twin-Disc. The Stearns magnetic clutch gives similar control, though using electromagnetic attraction in place of pneumatic expansion.

All of the clutches previously described have been relatively insensitive to speed variation, and as such are suitable for adjustable-speed drives. There is another group of clutches operated by centrifugal force which was originally developed to permit the driver to get up to speed

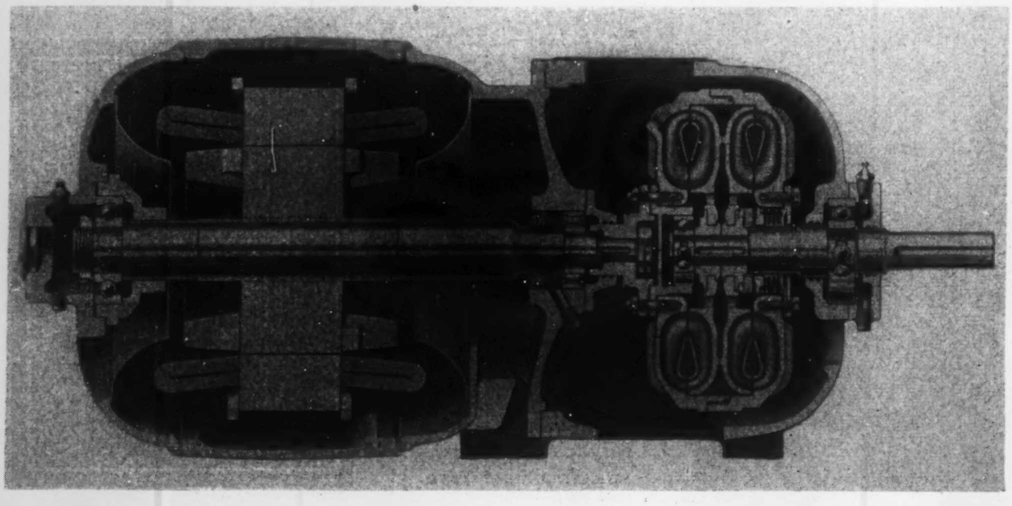


Fig. 11—Link-Belt electrofluid drive has built-in hydraulic coupling

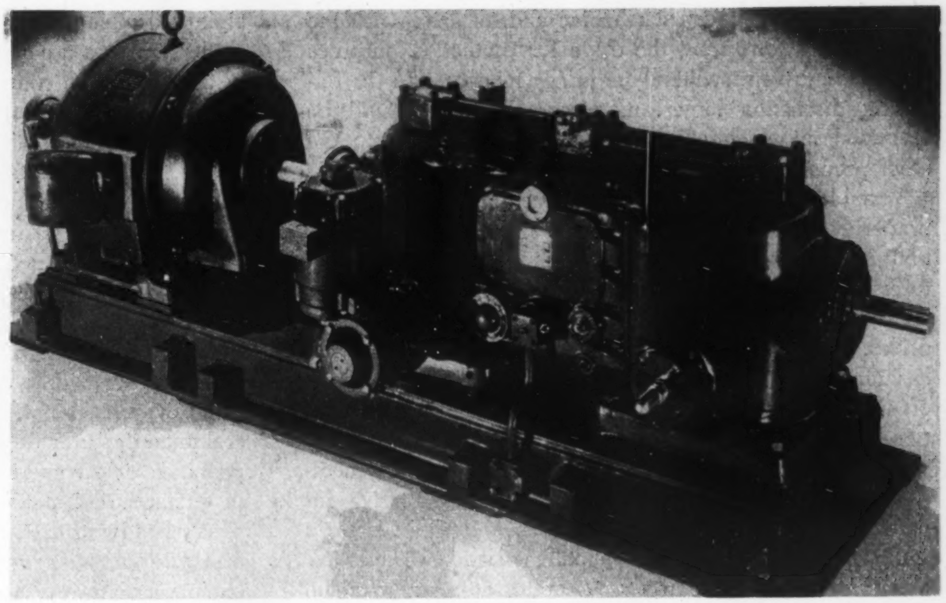


Fig. 12 — Vickers variable-speed hydraulic transmission utilizes pressure-relief valve for protection against overload

before engaging the load, as in the operation of reciprocating pumps and other high-starting torque loads. Such clutches are made by Rawson, Salsbury, Hilliard, Newago, and J. P. Madden, among others, and in general follow the principles indicated in *Fig.* 8. They can be used for overload release when properly rated. The Mercury clutch, *Fig.* 9, is an interesting variation in which pressure is applied by the action of mercury flowing by centrifugal force into an annular boot between the friction members. Other models have the particular advantage of ready adjustment by changing the amount of mercury.

The question of accuracy often must be considered. Although, as previously discussed, high accuracy is not needed on the usual drive, there will be a few situations where it is required. In order to attain high accuracy friction and inertia must be minimized. The commercial device coming nearest to this goal is probably the spring-loaded ball clutch used in many power screw drivers. Also, in any consideration of high accuracy the designer must remember that the slip device should be placed as near to the load as possible in order to minimize inertia.

For those interested in extreme accuracy, a permanent-magnet arrangement is suggested where the torque is determined by a micrometer air gap adjustment. Another device that has been used is the differential, wherein one leg is kept from rotating by such means as a precision hydraulic gear pump pumping directly into a precision relief valve. Power is then transmitted to the load only as long as the back pressure prevents it from turning.

Something of the same sort is found in the Philadelphia Gear Works PlaneTorque motor reducer which differs from the conventional planetary reducer in that the internal gear surrounding the planet gears is restrained only by adjustable preloaded springs acting against a lug on the gear periphery. When the reaction torque is sufficient to compress the springs further, the movement of the lug is detected by a limit switch which shuts off the power. Such a release is effective where the motor-coast distance is not objectionable or can be controlled by plugging or braking.

Thus far overload release devices have been considered

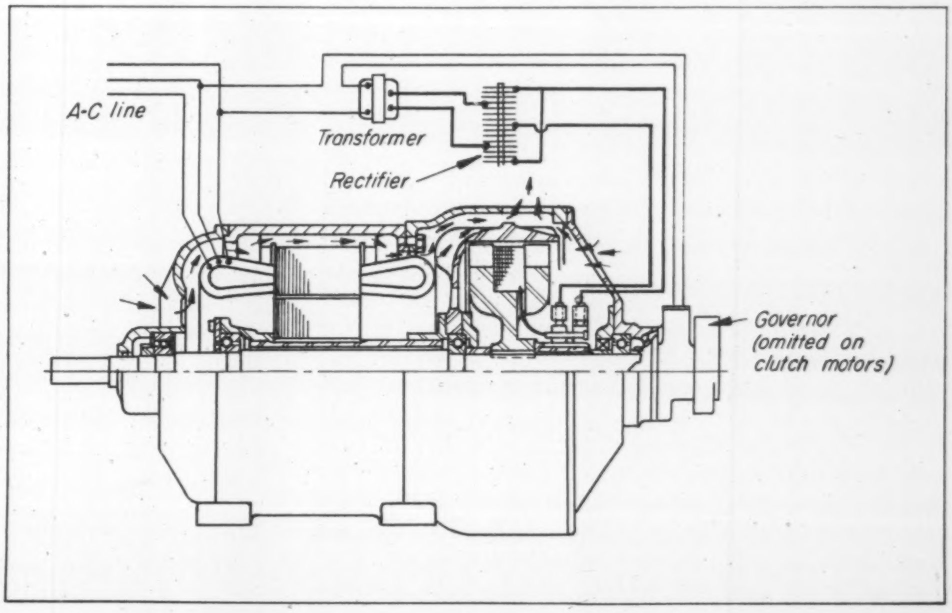


Fig. 13 — Adjusto-Spede motor. Eddy-current coupling controls output torque and speed of the unit

for installation between a machine and its drive with the purpose of interrupting the drive for protection purposes should the driven machine jam in any manner. In the following discussion larger, more complex drives will be examined in which overload control is incidental to the other properties provided.

Variable speed is one of the more important of these properties. Not all variable-speed transmissions provide built-in overload release, and in fact, certain manufacturers make a point of the heavy overload capacity of their drive; however, there is available a variety of releasing drives, some of which also provide smooth starting and cushioned running. Perhaps the simplest and cheapest of such arrangements would be any of the several friction-drive variable-speed transmissions so designed that slippage does not cause flatting or scoring of either member, such as the Sipp-Eastwood friction disk drive for yarn winders; the DoAll Speedmaster and the American Pulley Speed-Jack variable-diameter plastics sheaves for V-belt drive; and the more elaborate, all-metal Graham transmission, *Fig.* 10. These will slip reliably for short periods if slippage does not occur too often.

In order to prevent undue creep and wear, the drive should be selected so that the normal working load is at least 25 per cent below the slip point. It should be noted that these transmissions are not adjustable and that torque capacity increases as speed decreases.

Standard commercial hydraulic couplings offer many advantages for large installations where their relatively high cost is less a factor. They provide a slow and easy start, a cushioned drive, and a dependable overload release. Such drives have considerable heat capacity and are able to run long enough under full slip for the motor overload relay to kick out, a particular merit. *Fig.* 11 illustrates the new Link-Belt Electrofluid drive, in which the manufacturer has combined a motor with a hydraulic coupling in one compact installation. Hydraulic couplings are made by a number of manufacturers, including Twin-Disc and American Blower. On some models the latter company features a built-in oil scoop which circulates oil through the coupling into a cooler and secures variable torque and speed by adjustment of scoop pick-up.

Hydraulic System Utilizes Relief Valve

A different type of hydraulic drive can be arranged from a standard hydraulic pump powering a standard hydraulic motor. Variable speed can be obtained simply by using a variable-discharge pump, and overload release is provided as before by a pressure-relief valve. *Fig.* 12 illustrates the Vickers transmission, which combines pump and motor in one housing to form a standard commercial drive. The particular merit of the hydraulic pump-motor arrangement is that it provides a high order of control over both speed and torque and is particularly suitable for complex, highly integrated systems such as continuous-strip processes, which usually require synchronized pay-off, capstan, and wind-up motors. Accuracy and reliability are excellent, particularly if oil viscosity is kept constant with an oil cooler. Inertia of moving parts is comparatively low since hydraulic drives are inherently compact. Special hydraulic transmissions of this type are also made by Oilgear, Portman and Superdraulic.

Some of the newer electric drives are similar in principle and effect. In one of these, a standard 3-phase a-c motor powers a d-c generator of controllable voltage which in turn feeds the controlled-speed, controlled-torque drive motor. The principal limitation of such drives with regard to overload control is the unavoidable high armature inertia, which prevents effective shock release no matter how accurately the amperage is measured. Of course, if the load is not geared down, its inertia may be much greater than that of the armature. The thyratron drives, such as the Mototrol and Thymotrol, have the same advantages and disadvantages in these respects as the so-called Ward Leonard type previously mentioned.

A somewhat different a-c variable-speed drive is the Adjusto-Spede motor, made with minor variations by several manufacturers. As seen in *Fig.* 13, it has the appearance of an oversize wound-rotor motor and consists of a standard 3-phase a-c stator winding surrounding a squirrel-cage armature which is bolted to a secondary armature in the form of a large steel cup. Inside the secondary armature is a wound rotor which drives the load and which is supplied with d-c current through slip rings. The result is an eddy-current coupling in which output torque and speed depend upon the d-c excitation current. In a lesser degree, the Adjusto-Spede drive is subject to the high-inertia limitations of other electrical drives and should be used with caution where speedy disengagement may be necessary.

Is Protection Justified?

A question to be answered regarding any proposed installation is, naturally, whether special protection is justified. As has been indicated previously, the writer is inclined to advocate protection unless there is a good reason against it. After witnessing the havoc caused, for instance, by a broom carelessly laid against an unprotected wrapping machine, a user would prefer to have a slip clutch in his machine instead of a spare parts inventory. Damage caused by one unforeseen accident will pay the cost of many slip clutches.

In general, all types of automatic machinery powered by electric motors should be protected when the inertia of the motor armature is a major part of the total machine inertia. This suggestion applies particularly to reduction drives. The greater the reduction, the more important it becomes.

Protection should be used on machines processing breakable or damageable objects. Such machines include hoppers, packaging machines of all sorts, and machines with automatic feed of several components. Protection should be used on compound drives in which one motor provides for several different power demands in a given machine, particularly where one or more of these drives is relatively so light and fragile that an overload at this point would not be felt in the main drive. Protection should be used on any machine where failure of any part, poor timing, or a clash could result in a major tangle and breakdown. The needles of knitting machine are a case in point. Each subassembly of a machine should be studied carefully as to the possible results of a failure of any vulnerable part or function: The goal is that the machine "fail safe."

There are many opportunities for improving standard

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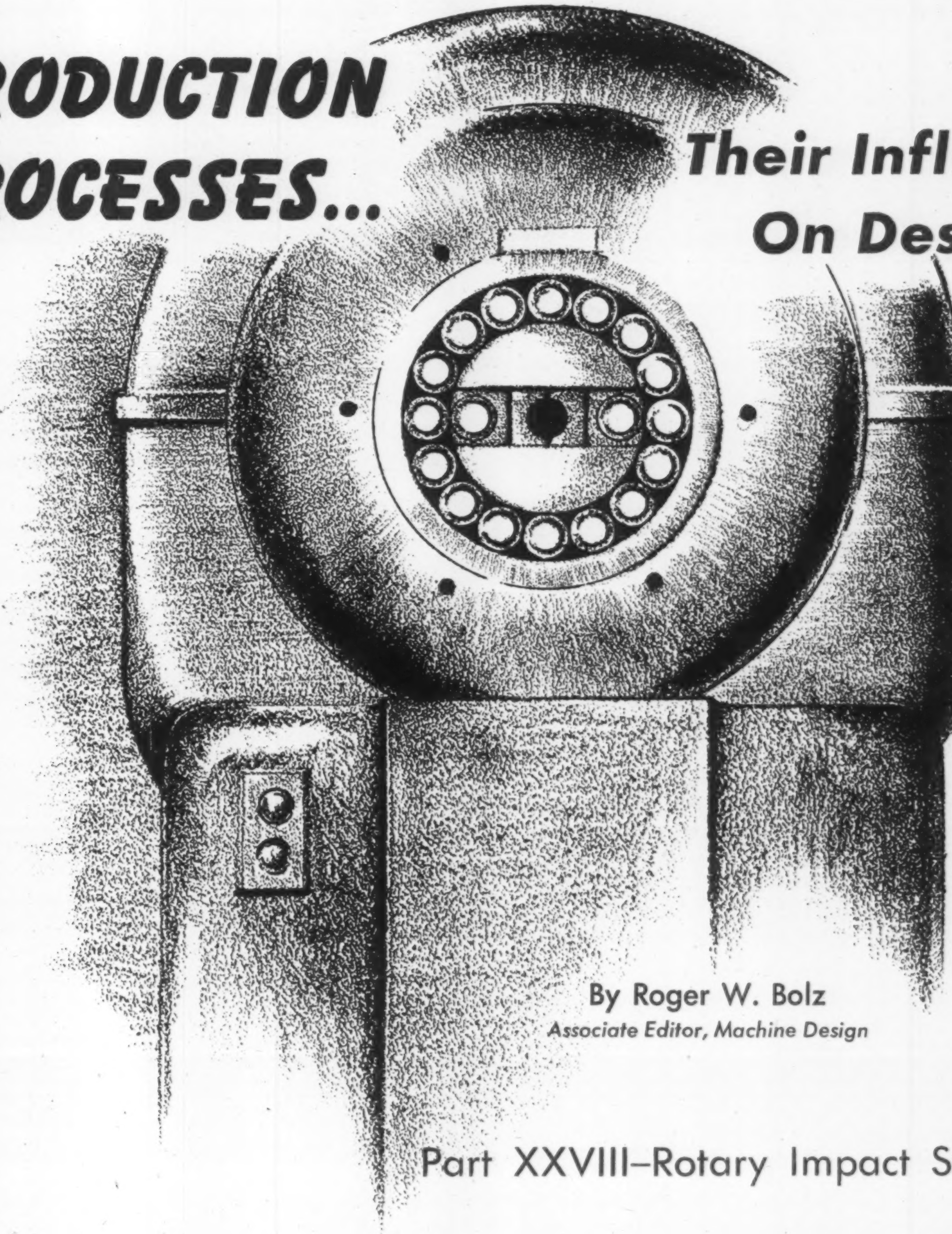
PRODUCTION PROCESSES... Their Influence On Design



By Roger W. Bolz

Associate Editor, Machine Design

Part XXVIII—Rotary Impact Swaging

SIMPLICITY and effectiveness of power squeezing or impacting methods as well as their unequalled economy rank them among the foremost mass production processes. Basically a fast mechanical hammering or impacting method, rotary swaging affords many of the desirable characteristics inherent in hot and cold forming methods.

Perhaps more accurately termed as rotary reducing, the swaging process is, broadly speaking, confined to the reducing of a symmetrically cross-sectioned metal blank to a desired shape or form. Much as with the thread and form-rolling process, this factor places specific limitations upon the range of design possibilities, but savings in material, production economy and the fact that certain parts cannot be easily produced by other means makes it imperative that swaging be kept in mind by the designer in evaluating possible methods of production.

In swaging, the blank is fed by hand or mechanically into the die openings where thousands of hammer blows per minute conform the blank to the shape of the dies used. Blanks ordinarily may be of any symmetrical cross section, although the actual finished swaged form, being produced by a series of fast hammer blows accumulatively applied about a circle, must be substantially of circular

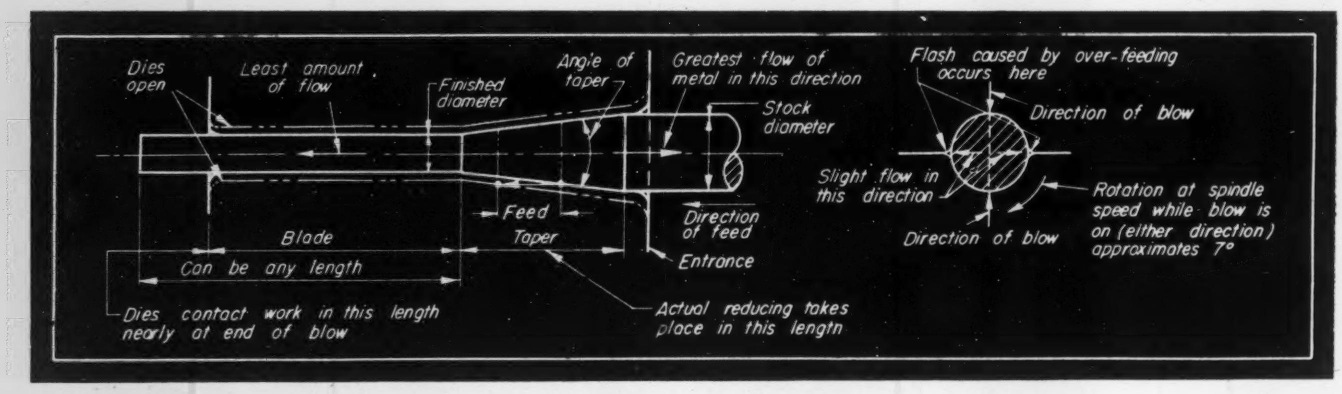

Dies open
Least amount of flow
Finished diameter
Angle of taper
Greatest flow of metal in this direction
Stock diameter
Flash caused by over-feeding occurs here
Direction of blow
Slight flow in this direction
Rotation at spindle speed while blow is on (either direction) approximates 7°
Direction of blow
Feed
Taper
Blade
Direction of feed
Entrance
Can be any length
Dies contact work in this length nearly at end of blow
Actual reducing takes place in this length

Fig. 1—Characteristic metal flow conditions normally accompanying the cold-swaging operation

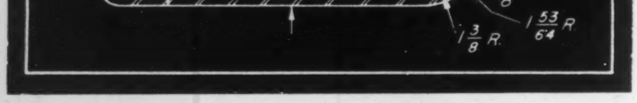
cross section. Along the length of the part, however, an almost unlimited variety of forms can be produced.

Under normal conditions each blow of the machine produces a flow of metal approximately shown in *Fig.* 1. Where angle of taper is too great the metal feedback encountered requires the use of power feed devices. Flow, however, takes place in all directions but the amounts in each case depend upon such factors as the particular part design, metal being swaged, condition of the dies, etc.

Swaged parts may be either hollow or solid. In either case the working of the metal through swaging refines the grain structure and improves metal quality. Parts produced by cold swaging exhibit the highly desirable characteristics which normally accompany cold-worked metal. Extent of the effects of cold working depends largely upon the machine used. A light machine on a heavy piece only has a slight surface effect while an adequate machine produces the maximum beneficial effect. Blanks cold worked on the surface only show concave and faces while those thoroughly worked show a definite bulge at the same point.

High quality finish and increased strength, however, are usually sacrificed when swaging hot, which often is necessary with highly work-hardening materials or extremely severe reductions, *Fig.* 2. Normally, therefore, hot swaging should be avoided wherever possible for maximum economy in production and where fine surface finish is desirable without machining.

Fig. 2—Heavy-wall, low-carbon steel bottle swaged hot in one operation. Swager equipped with a pneumatic feed holder and hand gripping device provides a production rate of 2 to 3 pieces per minute


5/16
3 21/32
Blank
1/4
Trim after swaging
13 1/4 Fin
1 3/8 dia
3/8 R
1/2 R
3 21/32 dia
1/4
1/8
1 53/64 R
1 3/8 R

The field of design for swaged parts can be divided generally into three broad classifications: Pointing, forming and attaching. Examples of pointing are spouts, valve needles, bayonets, automatic pencil points, pen caps, and shell noses, *Fig.* 3. Forming includes a much wider field such as valve stems, roller chain bushings, sizing bearing rollers, central reductions on tubular parts, shell cases, axle housings, torque tubes, struts, axles, radio antennas, masts, etc., *Fig.* 4. Attachment applications involve the swaging on of fittings and other attachments to cables, wire, hose, etc., *Fig.* 5.

Consisting principally of a cage of rollers within which the swaging dies rotate, the swaging machine is relatively simple in design. Rotation of the die head causes the die shoes to strike the rollers, closing the dies against centrifugal force in rapid succession. Owing to slow rotation of the roller cage on contact with the dies, the actual number of blows per minute is somewhat less than the product of the rpm and the number of rolls. At 600 rpm, however, a 10-roll head produces about 3750 blows per minute.

Either 2 or 4 Dies Can Be Used

Both 2 and 4-die arrangements are employed in standard swagers. Because the 4-die head practically doubles the working surface, speed of reduction is materially increased and heavier work can be handled. However, finish obtained with the 4-die setup is somewhat inferior to that of the 2-die arrangement. Too, inasmuch as die contact area is reduced to about half that with 2 dies, only large parts can be handled successfully. Generally, the 4-die principle is not applicable where the reduced diameter is less than 3/16-inch

Capacity of various machines is based upon the assumption that maximum diameter work specified is to be swaged the full length of the dies. Where length is less than die length, work diameter may be increased in inverse proportion limited only by the available die size. This also applies to hollow work and is based on tubing with wall thickness no greater than one-half the diameter of solid work capacity. Usually machine capacity on solid stock is roughly about one-half that on tubing.

Smallest machines available have a capacity on solid work of 1/16-inch and smaller, on tubing of 5/16 and under, while longest taper possible in one operation is 7/16-inch. A wide variety of swagers is available, *Fig.* 6, carrying the tubing capacity range up to about 6½ inches, solid

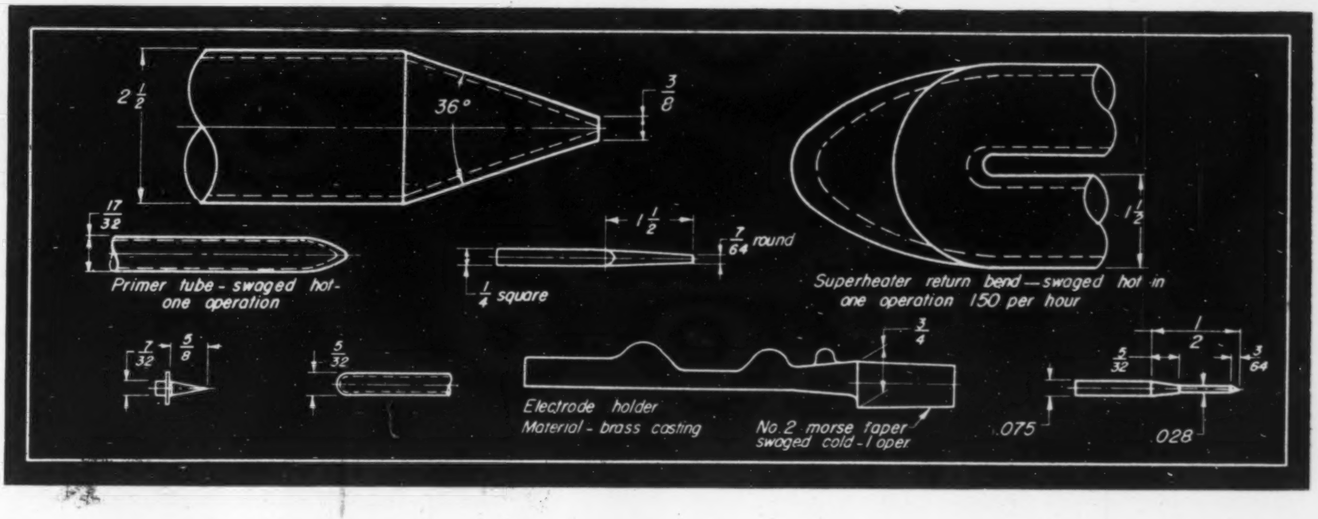
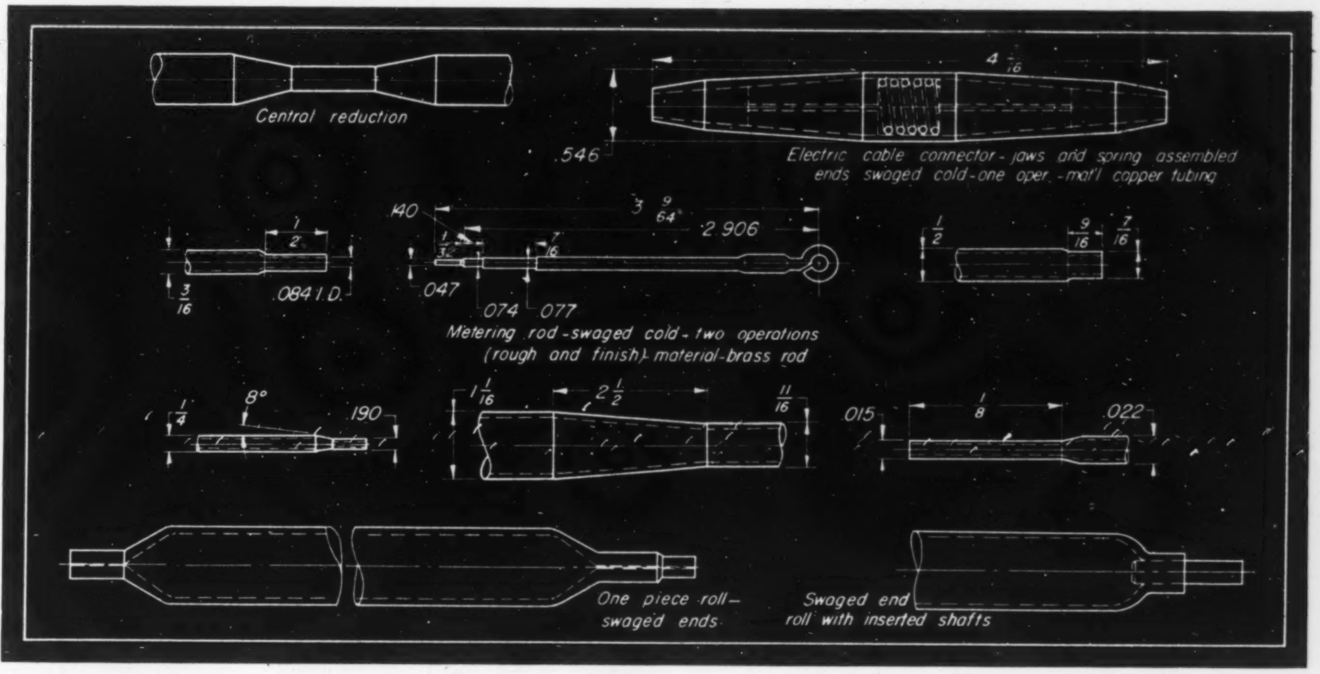

2 1/2
36°
3/8
17/32
Primer tube - swaged hot- one operation
1 1/2
7/64 round
1/4 square
Superheater return bend—swaged hot in one operation 150 per hour
1 1/2
7/32
5/8
5/32
3/4
Electrode holder
Material - brass casting
No. 2 morse taper swaged cold - 1 oper
1/2
5/32
3/64
.075
.028

Fig. 3—Above—Group of cold and hot-swaged parts representative of pointing operations

Fig. 4—Below—Representative of forming operations are these various swaged parts

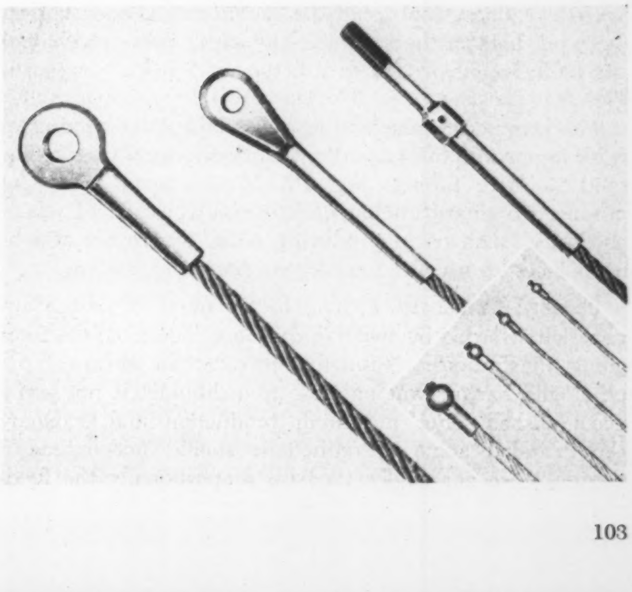

Central reduction
.546
Electric cable connector - jaws and spring assembled ends swaged cold - one oper. - mat'l copper tubing
1/2
3/16
.084 I.D.
.140
3 9/64
2.906
1/32
7/16
.047
.074
.077
Metering rod - swaged cold - two operations (rough and finish) - material - brass rod
1/2
9/16
7/16
1/4
8°
.190
1 1/16
2 1/2
11/16
.015
1/8
.022
One piece roll-swaged ends
Swaged end roll with inserted shafts

round capacity up to about 3¾ inches and length of taper possible in one operation to about 18 inches. Capacities are normally based upon mild steel, softer materials allowing a proportionate increase and harder ones a decrease.

In general swaging is a fast operation. Average feed rate for reductions on either solid or tubular work is ¾ to 1-inch of swaging per second. Speed, of course, will vary from this figure according to design and other conditions but it is sufficiently close for all reductions up to a 15-degree included angle.

For large-quantity production swaging, and for work which cannot be handled by hand, various types of feeding devices—hand operated, semiautomatic or fully automatic—are available, *Fig.* 7. For sizing operations continuous roll feeds are usually used but for tapering and reducing the hydraulic devices available generally provide the best results. For parts requiring a central reduction,

Fig. 5—Below—Group of machine fitting attachments produced by cold swaging



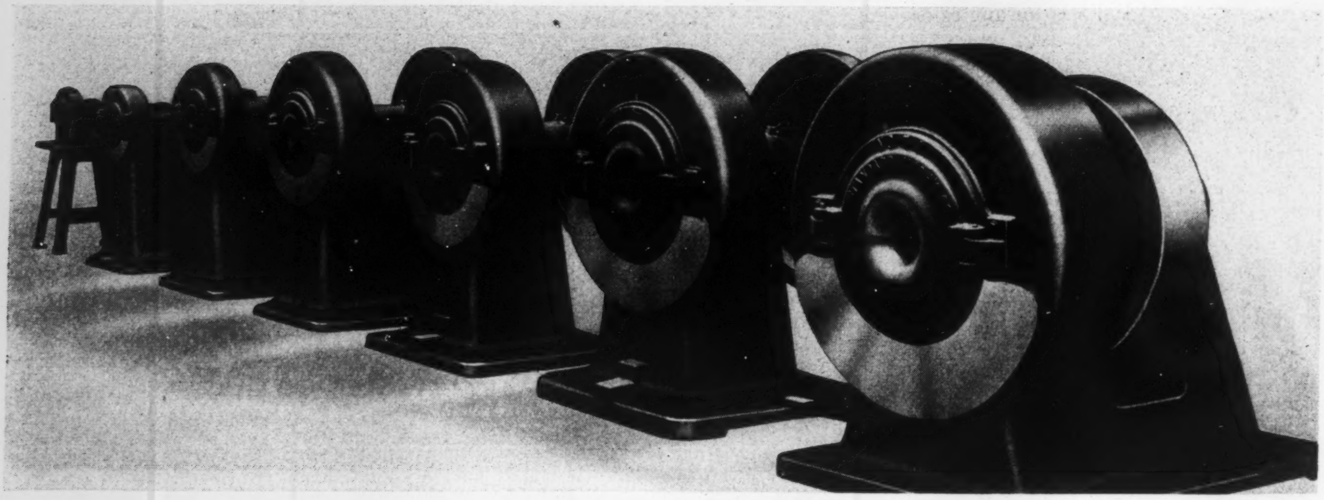


Fig. 6—A wide variety of standard swagers are available providing considerable leeway in design of parts

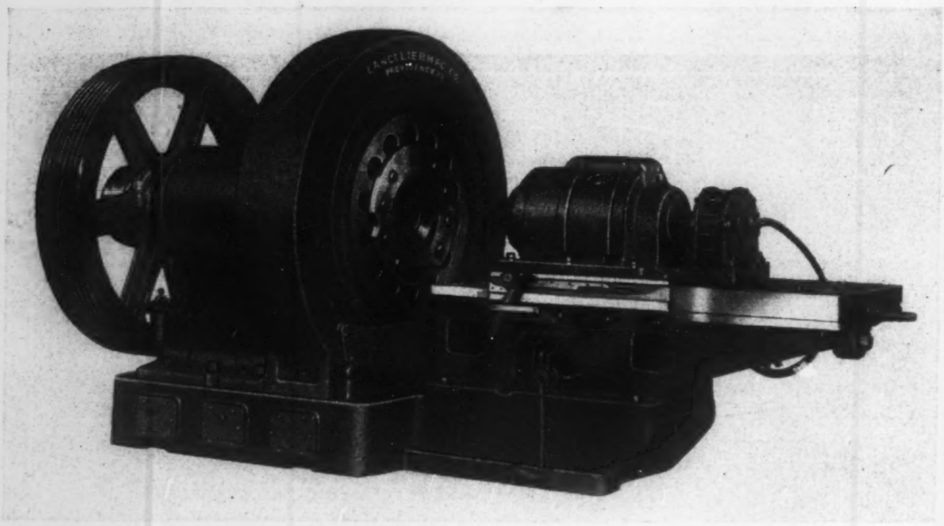


Fig. 7 — Water-jacketed for hot or cold work, this machine is equipped with a hydraulic feed mechanism and a hydraulically operated rotating chuck. Quick advance and swaging feed are adjustable to suit requirements of production

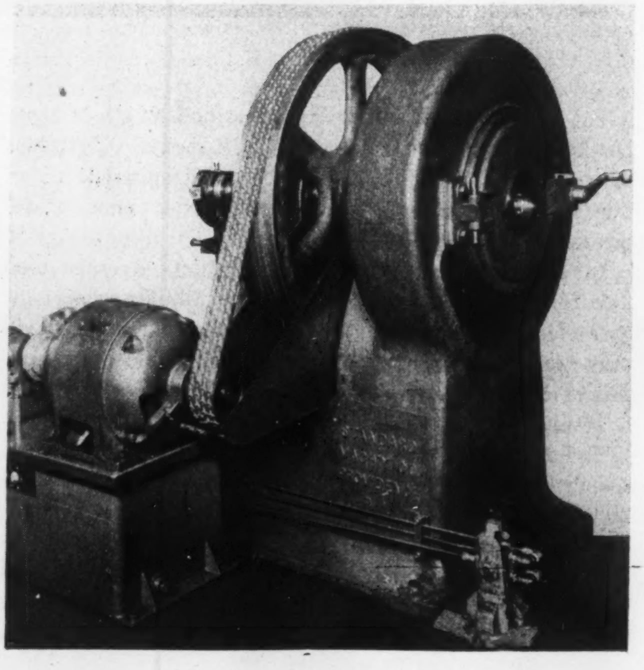
Fig. 4, specially designed machines are required so as to allow entry and removal of large ends, *Fig.* 8, either before or after swaging.

An interesting adjunct to the swaging process is that known as hammering. Principle of operation is very similar to that of swaging and like swaging offers the advantage of cold working and economy of material. Hammering, however, is done by two dies operating in a vertical plane, the upper die reciprocating and striking the work held in the lower die, which is either mechanically or hydraulically fed to suit the work being produced, *Fig.* 9.

The hammering machine is well adapted for producing work impossible to swage. Parts can be formed from either solid stock or tubing, *Fig.* 10. Where round parts are produced a rotary attchment is normally used and where necessary, such as in producing balls, the rotary attachment includes a collet feed for continuous operation.

DESIGN: A general idea as to the range of design application afforded by swaging can be gained from the foregoing illustrations. Normally, swaging an abrupt taper on a solid bar or swaging close to a shoulder is not easily accomplished. For maximum production and economy the included angle of reductions should not exceed 8 degrees. Steeper angles increase proportionally the feed-

Fig. 8—Below—Swager equipped with hydraulic die opener for producing central reductions on parts



ing pressures required and for angles exceeding 12 degrees, feeding fixtures usually are imperative. On tubing the included angle of reduction does not present quite as great a problem, but large angles on heavy reductions necessitate either hot working or more than one operation, *Fig.* 11, adding to production cost. Again, too great an angle on tubing often causes hard swaging and produces wrinkling or roughness in the finished part unless the work is performed in easy stages. Normally, to avoid wrinkling or corrugating troubles on tubing, the O.D. must be less than 35 times the wall thickness.

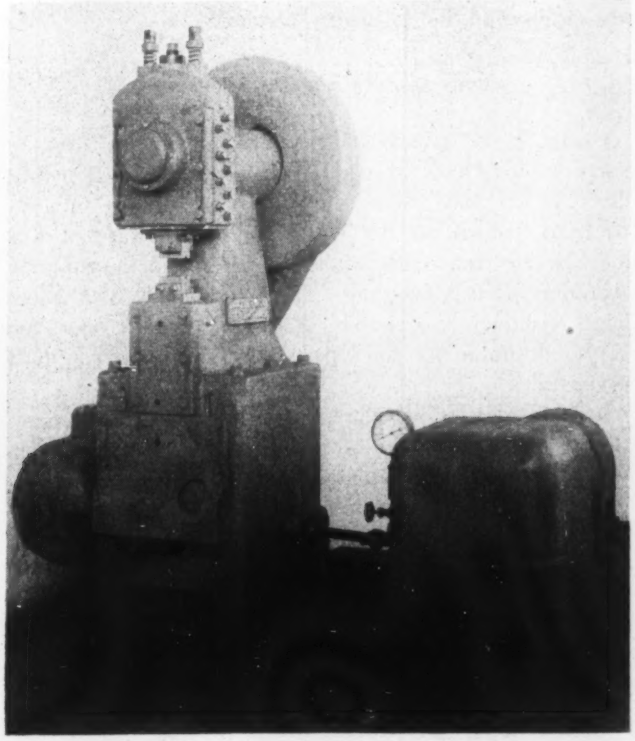
Thin-Wall Tubing Requires Support

On pointing operations the smallest radius of point that can be produced is about 0.010 to 0.015-inch. Good practice recommends a minimum radius of 0.015-inch be specified. Pointing on fairly heavy tubing normally requires no mandrel for support but thin-wall tubing always does. Pointing, of course, creates a thickening of the tube wall rather than merely a lengthening action as with solid stock, so for economy in production this condition should be acceptable. Of course, wall thickness can be maintained with a mandrel, provided such can be employed. If possible, in all cases where mandrels must be used, a taper should be allowed, however small, in order to facilitate removal of the parts from the mandrel in production. Representative of mandrel parts are tube sizing, pencil tips, torch tips, some types of thermostatic control bulbs, etc.

Length of section which can be swaged, as well as diameter, depends upon the size machine available and normally falls within the general overall limitations covered previously. With cylindrical sections, of course, length is unlimited.

Wire can be swaged to shape or sized down to diameters as small as 0.005-inch. This, however, represents a minimum and is seldom, if ever, decreased. On all forms, wherever possible, sharp corners should be replaced with generous radii to insure good die life and aid movement of metal.

Fig. 9—Below—A hammering machine equipped with a hydraulically operated lower die



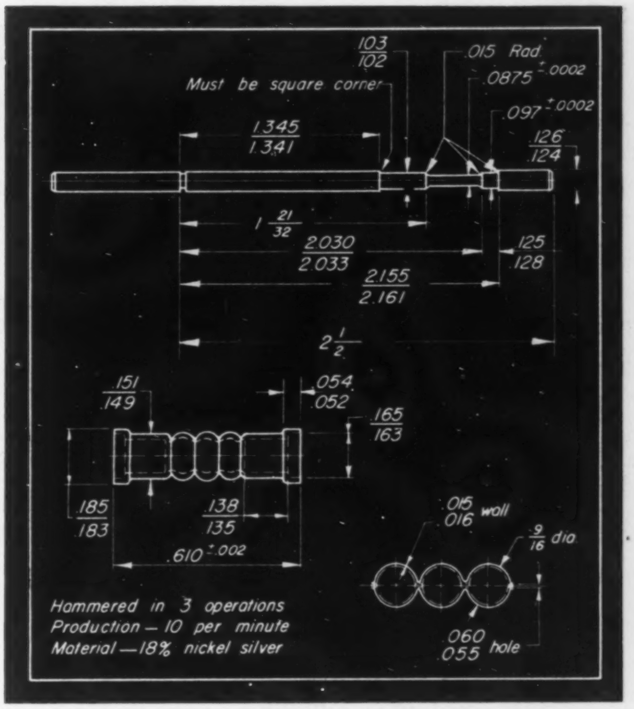


Fig. 10—Several representative parts produced on the hammering machine with a rotary attachment

Ferrules or attachments can be swaged onto an inner member tightly enough to withstand a tensile strain about equal to that of the inner member. Cross section of the ferrule or attachment, however, must be strong enough to provide the proper bond and gripping strength, which is approximately proportional to the strength of the ferrule cross section used.

Where sleeves are to be swaged over a shaft, volume of metal needed to fill the recess completely, *Fig.* 12, must be computed and exact length for production should be ascertained by trial owing to variations in stock temper, ductility, etc.

Materials: Those materials which are most easily cold worked ordinarily lend themselves to most economical production in swaging. Stainless steels, high-carbon steels and alloy steels which show the greatest work-hardening effects, of course, show the greatest increase in strength but are most difficult to swage. As a rule, such materials require annealing after a 30 to 40 per cent reduction in area.

Work-Hardening Materials Handled Hot

In swaging tungsten, molybdenum, and the other harder metals, it is generally necessary to perform the operation hot. In hot work there is no limiting ratio of tube O. D. to wall thickness or limit to the amount of reduction. However, as previously mentioned, hot working leaves a rather poor surface which requires machining if high accuracy is required. Steels such as chrome-moly which decarburize rapidly at hot-working temper-

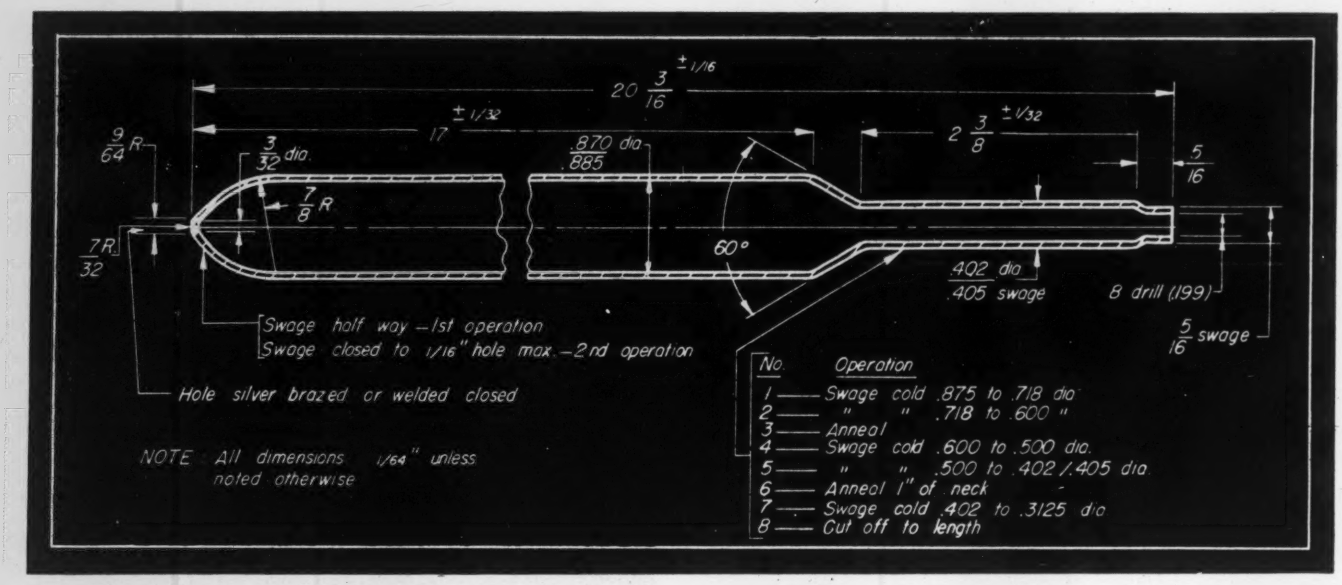

20 3/16 ± 1/16
17 ± 1/32
2 3/8 ± 1/32
9/64 R
3/32 dia.
7/8 R
7/32 R
.870 dia
.885
60°
.402 dia
.405 swage
5/16
8 drill (.199)
5/16 swage
Swage half way – 1st operation
Swage closed to 1/16" hole max. – 2nd operation
Hole silver brazed or welded closed
NOTE All dimensions 1/64" unless noted otherwise
No. Operation
1 —— Swage cold .875 to .718 dia
2 —— " " .718 to .600 "
3 —— Anneal
4 —— Swage cold .600 to .500 dia.
5 —— " " .500 to .402/.405 dia
6 —— Anneal 1" of neck
7 —— Swage cold .402 to .3125 dia
8 —— Cut off to length

Fig 11—Above—Bulb for temperature controller cold swaged from copper, stainless iron, Monel and steel tubing in several steps with intermediate anneals

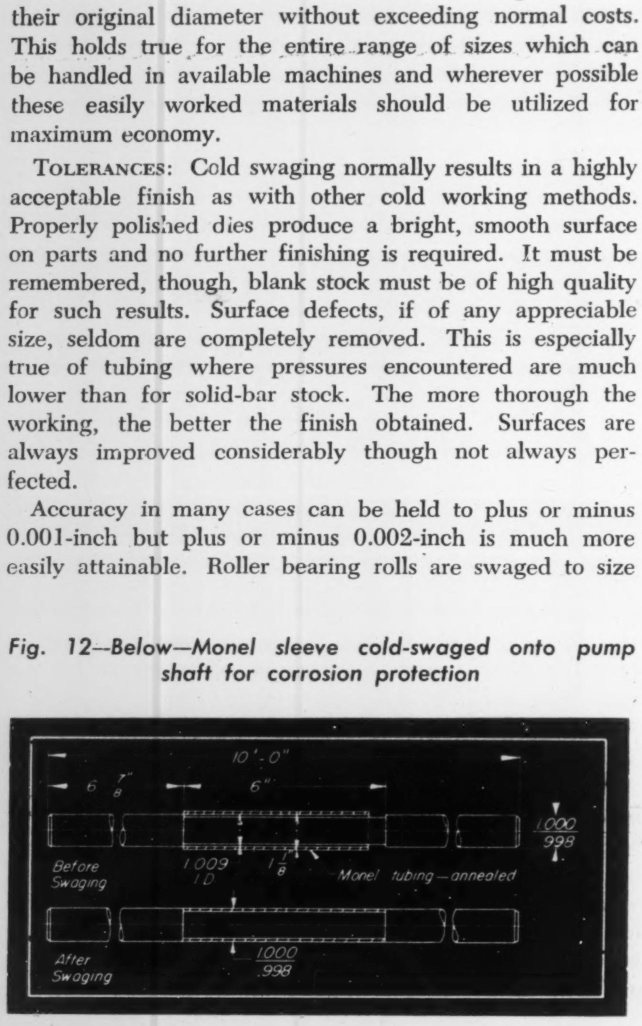
atures cause production difficulties especially if subsequent heat treatment is necessary.

Light and average-weight tubing in low and medium-carbon varieties where O.D. to wall thickness ratio is under 35 to 1, can be reduced to 60 or 65 per cent of their original diameter without exceeding normal costs. This holds true for the entire range of sizes which can be handled in available machines and wherever possible these easily worked materials should be utilized for maximum economy.

Tolerances: Cold swaging normally results in a highly acceptable finish as with other cold working methods. Properly polished dies produce a bright, smooth surface on parts and no further finishing is required. It must be remembered, though, blank stock must be of high quality for such results. Surface defects, if of any appreciable size, seldom are completely removed. This is especially true of tubing where pressures encountered are much lower than for solid-bar stock. The more thorough the working, the better the finish obtained. Surfaces are always improved considerably though not always perfected.

Accuracy in many cases can be held to plus or minus 0.001-inch but plus or minus 0.002-inch is much more easily attainable. Roller bearing rolls are swaged to size within plus or minus 0.002-inch in continuous lengths. Internal bores also have been mandrel swaged to within plus or minus 0.002-inch on diameters up to 1.500 inches. There is no guarantee in swaging tubing that the wall will thicken uniformly. Holes, therefore, are somewhat rough and of imperfect finish so that for accurate bores a mandrel is imperative.

Fig. 12—Below—Monel sleeve cold-swaged onto pump shaft for corrosion protection


10'-0"
6 7/8
6"
1.000
.998
Before Swaging
1.009 I.D.
1 1/8
Monel tubing — annealed
After Swaging
1.000
.998

Wall thickness, even with a manrel, will only be relatively uniform. Precise walls are not always possible inasmuch as there is no method of confining the mandrel to the center of the tube to obviate deflection. However, the *average* wall thickness will be as uniform as the difference in the O.D. and I.D., which is usually within an acceptable tolerance range. Generally, the hole centerline will never reach an eccentricity greater than plus or minus 0.010-inch in relation to the swaged diameter centerline. Maximum angularity of the swaged diameter centerline with the true part centerline is about ½ degree. Where power feeding fixtures are used this angularity condition is readily obviated.

Ends Usually Require Trimming

Owing to difference in metal movement in swaging heavy tubing, ends of parts usually show a bell mouth effect which may extend into the bore of the tube as much as ½-inch on the largest parts. Because of this and the fact that ends usually come rough, a trimming operation often is necessary. This is especially true where length accuracy is desirable. A trimming cutoff operation is also desirable on solid parts where precise length is necessary.

A good idea as to tolerances available with the hammering machine can be gained from the parts shown in *Fig.* 10 which are representative of machine parts normally produced on this equipment.

Collaboration of the following organizations in the preparation of this article is acknowledged with much appreciation:
Douglas Aircraft Co. Inc. .... Santa Monica, Calif.
Etna Machine Co. .... Toledo, Ohio
Langelier Mfg. Co. ....
Fig. 2, 3, 4, 7, 9, 10, and 12) .... Providence, R. I.
Standard Machinery Co. (*Figs.* 5, 6 and 8) .. Providence, R. I.
Taylor Instrument Co. (*Fig.* 11) .... Rochester, N. Y.
Torrington Co. (*Fig.* 1) .... Torrington, Conn.

Pneumatic Control Speeds Hydraulic Press Response

By P. T. Delmer
The Hydraulic Press Mfg. Co.
Mt. Gilead, O.

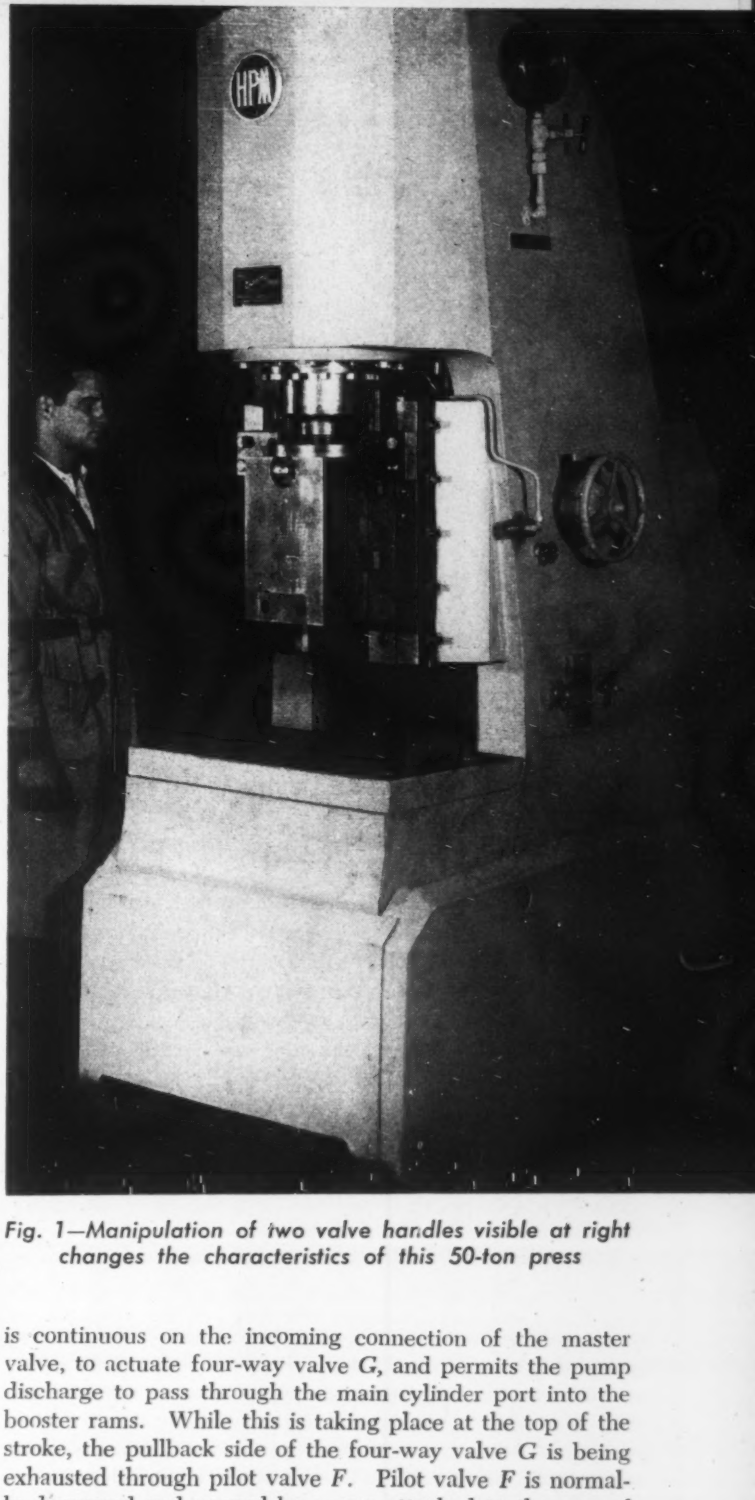


Fig. 1—Manipulation of two valve handles visible at right changes the characteristics of this 50-ton press

NEED for a versatile, small-tonnage press which would combine the advantages of hydraulic operation with the speed of a small mechanical press led to the development of the machine shown in *Fig.* 1. Factors which have heretofore limited high-speed hydraulic press operation are: Effective prefill of the main cylinder; lag in the controls; and dwell at the bottom of the stroke. Certain refinements have been made to eliminate these difficulties, as will be explained in this article.

While the operating system of the press is all hydraulic, a pneumatic control system was chosen after an intensive investigation of means to obtain close control at high speeds, under variable methods of operation. Mechanical control was ruled out as not being flexible enough to handle various operating cycles without undue complication. Electrical control, heretofore extensively used, is a convenient means which lends itself well to variable cycles, but this type was passed by because of the limited life which could be expected from such elements as solenoids at 100 strokes, or more, per minute.

The air system is tied into the hydraulic system directly at the main four-way operating valve *G*, *Fig.* 2. Press controls are simple, and easily accessible to set up any one of four modes of operation: 1. Single stroke, nonrepeat; 2. Continuous reciprocation by foot pedal; 3. Full automatic; and 4. Precision inching control. Changeover from one mode to another is effected primarily by manipulation of the two globe valves *A* and *B* shown in *Fig.* 2.

SINGLE-STROKE, NONREPEAT OPERATION: With globe valve *B* open and *A* shut, depressing the foot pedal allows a shot of air pressure to flow to and actuate the master valve *E*. This valve is normally open to the pullback side of the four-way valve *G* and the shot of air changes the cross connection from the pullback to the main cylinder side of four-way valve *G*. This allows the pressure, which is continuous on the incoming connection of the master valve, to actuate four-way valve *G*, and permits the pump discharge to pass through the main cylinder port into the booster rams. While this is taking place at the top of the stroke, the pullback side of the four-way valve *G* is being exhausted through pilot valve *F*. Pilot valve *F* is normally depressed and opened by a cam attached to the rear of the main slide, but drops off the cam at the top of the stroke. The other exhaust line, which is shown coming from the top side of four-way valve *G* is exhausted through the same pilot valve. The main four-way operating valve *G* is a double-piston arrangement, a smaller piston and rod being on the top side under continuous pressure from the air line. By exhausting the lower side of the smaller piston, exhausting the pullback side and applying pressure to the main cylinder side, the four-way valve becomes unbalanced and is allowed to shift.

As the ram moves down, the surge check, *Fig.* 2, opens and prefills the main cylinder; the pump discharge, however, is being taken into the booster rams only, since the ram has not advanced far enough to make a cross connection and to allow pump discharge into the main cylinder through the drilled holes in the ram. As the ram advances, the oil in the differential area is discharged from the center port of the four-way valve *G*.

Continuous Reciprocation by Foot Pedal: With main control valves *A* and *B* closed, the air pressure bypasses these valves and advances to pilot valve *J* which is actuated momentarily at the top of the stroke, allowing a shot of air to the foot pedal. By keeping the foot pedal depressed, a shot of air will actuate the master valve *E* every time the slide reaches the top of its stroke and depresses pilot valve *J*. This allows pressure to flow to the four-way valve *G* by actuating the master valve. The discharge of the pullback air lines is the same as in the case of the previous operation, and the hydraulic part of the system follows the same sequence.

Pilot Valve Controls Automatic Cycle

Full Automatic Operation: With globe valve *B* shut and *A* open, air pressure advances to pilot valve *J* which is actuated at the top of the stroke and, when depressed, allows air pressure to pass to the master valve *E* through the open globe valve *A*. Actuating master valve *E* allows a shot of air pressure to flow to the main cylinder side of the four-way valve *G*, causing it to shift. Discharge of the air pullback side is the same as for the previous operations.

In *Fig.* 2 the ram is shown in the up position, but when it advances to the point of cross connection with the booster cylinders the pump discharge flows through the four-way valve, *G*, and the bored holes in the booster rams into the main cylinder to achieve full pressure. The differential area exhausts as in the previous operation.

Precision Inching Control: When it is desired to inch the press slide for the purpose of die set-up or die alignment, the controls will be set similar to either operations 1 or 2, that is, nonrepeat or continuous reciprocation by foot pedal. To inch the press slide, assuming the press is operating as in the second mode with the slide reciprocating through foot pedal operation, adjustment is made on the radial pump to cut the discharge into the boosters and main cylinder while the ram is reciprocating, until the desired speed is achieved. Stopping the downward movement of the slide at some desired point can be accomplished by adjustment of globe valve *O* which is connected from relief valve *K* to the tank.

Reverse Operation: The press is reversed when the pressure is built up in the main cylinder side of the four-way valve *G* sufficiently to actuate the tonnage control *L*. Forward movement of the control actuates the pilot valve *H* allowing the forward part of the air system to exhaust through it. This permits master control *E* to return to normal position open to the pullback of the four-way valve *G*, causing air pressure to cross pilot valve *F*, which is depressed at that portion of the stroke by a cam on the rear of the slide. The underside of the top piston in the four-way valve is exhausted through the master valve *E*, allowing the four-way valve to become unbalanced and shift to the pullback.

The pump discharge is then delivered to the differential area of the main ram, while the small line from the resistance valve *N*, which leads to the surge check, causes the surge check to open and permits the main cylinder to exhaust into the tank.

Flywheel: In addition to effective prefill of the main cylinder and fast-acting pneumatic controls, already discussed, operation is further speeded up by reducing the dwell customarily experienced at the bottom of the stroke of a hydraulic press. This is accomplished by means of a flywheel on the shaft of the pump, the stored energy in which relieves the load on the motor and tends to hold the pump on full stroke during the pressing operation, thereby delivering full volume at full pressure to the cylinder. Otherwise when the load is encountered and the surge check closes the press would slow down.

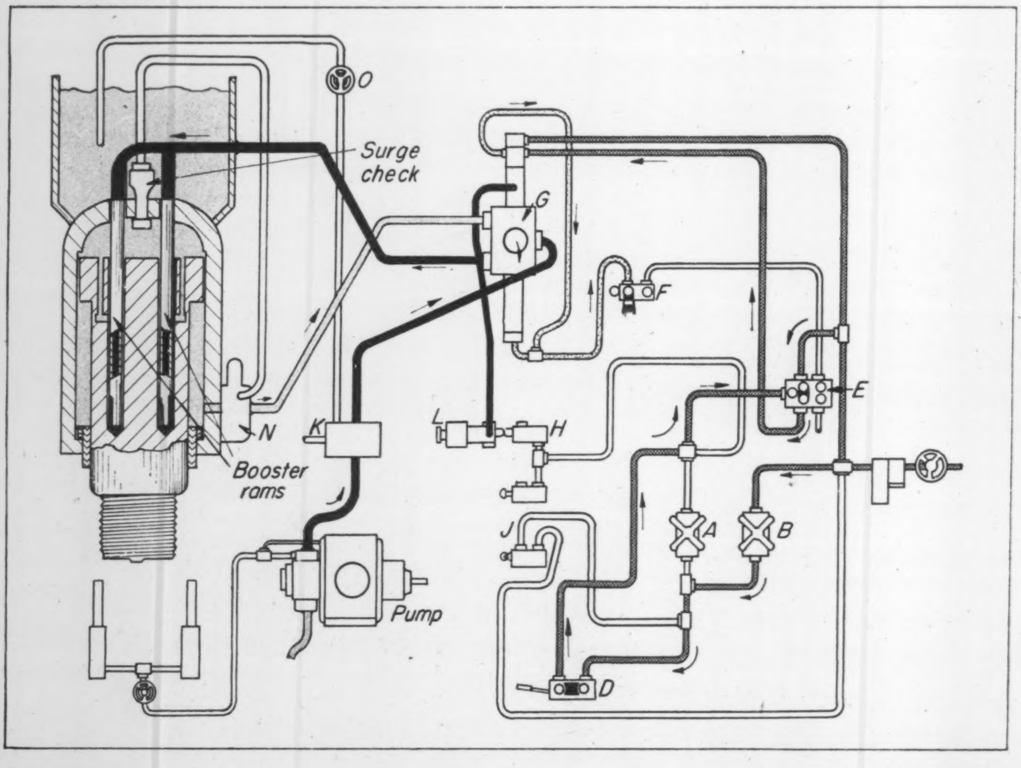


Fig. 2—Pneumatic control circuit and hydraulic operating circuit for press showing location of manually controlled change-over valves A and B. Arrows indicate flow of air and oil at beginning of single-stroke nonrepeat operation

Make the Most of Today's Materials!

Of all the problems with which the machine designer is confronted, few have more far-reaching effects than the selection and specification of materials. Yet some otherwise competent engineers, even today, seem to be almost illiterate in the field of materials and their processing.

For example, it is not always remembered that handbook data on the mechanical properties of engineering materials usually are based on the average results of laboratory tests on smooth high-grade specimens. Neglect of such factors as deviations from the average and the effects of size, surface conditions and processing operations may render utterly worthless the most skillful design and the most painstaking stress calculations. Again, disregard of such characteristics as machinability, formability, weldability, etc., can spell the difference between economical processing on the one hand and endless production headaches on the other. Cost is a vital and ever-present factor and in these days availability and quick delivery may narrow the choice to relatively few materials.

Judicious selection must be accompanied by adequate specification. Not so long ago designers were content to designate the desired material by simply writing "MS," "CRS," "Brass," or similar vague description, trusting to chance and the judgment of the purchasing agent for the actual specification. Today such offhand methods are totally inadequate, and entirely unnecessary. Trade names and standard specification numbers now cover virtually every type of requirement and should be used to put the "specific" into specification.

Search for the ideal material must be a never-ending one and time spent on it will pay big dividends in increased production efficiency, lower ultimate costs and improved relations with those responsible for production. To assist the designer in the two-fold task of selection and specification MACHINE DESIGN'S Directory of Materials, the fourteenth edition of which is published in this issue, is offered as a convenient guide to currently available materials. It is hoped that in its new, more compact form the directory will facilitate finding quickly the key information needed in the evaluation of engineering materials.

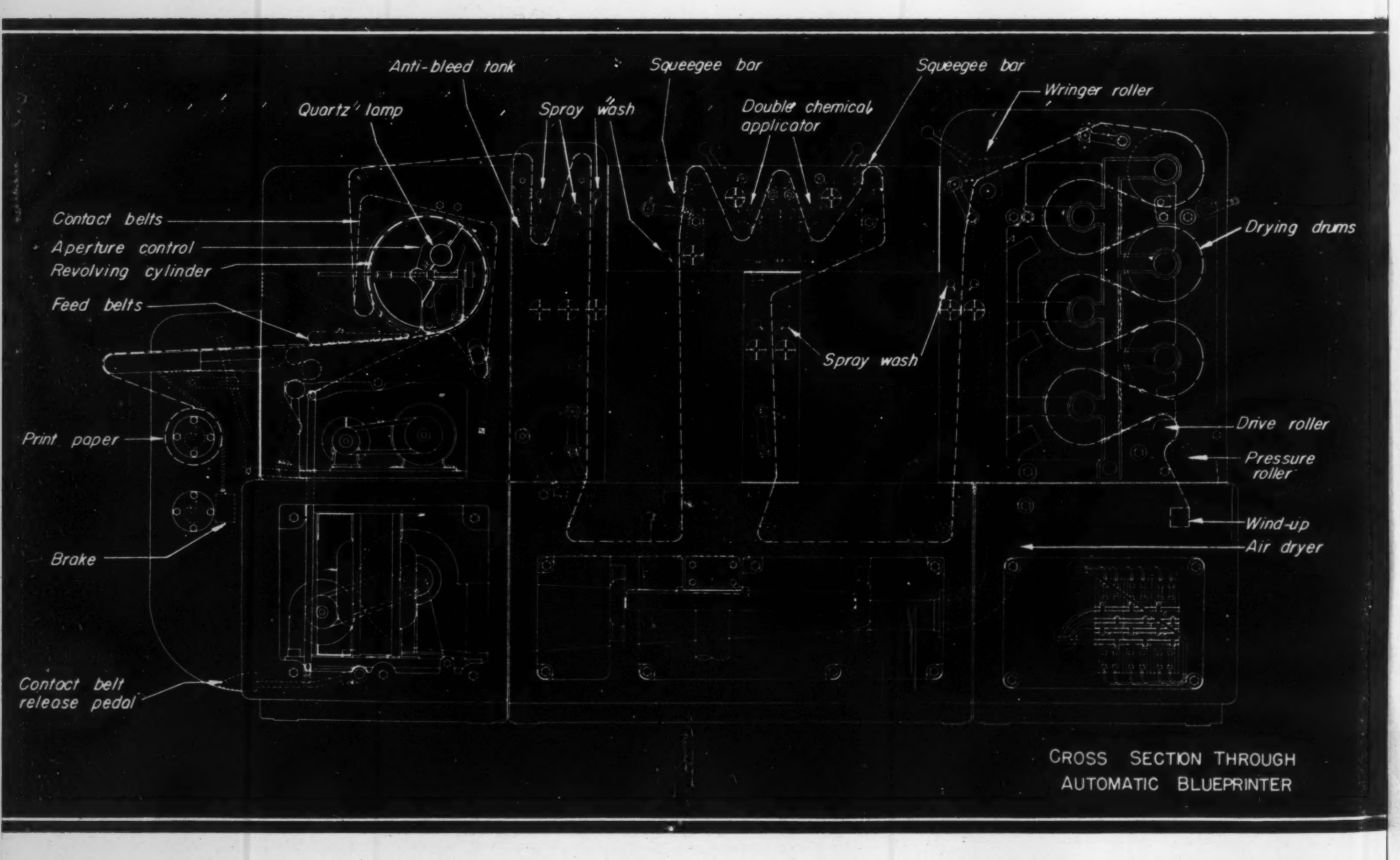
Colin Carmichael

DESIGNS OF THE MONTH

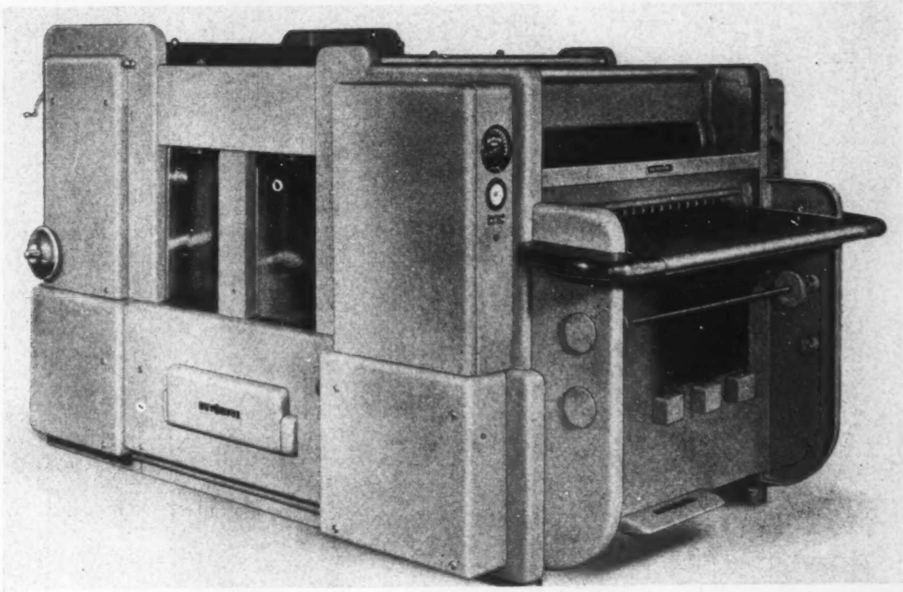
Revolving Contact Principle Used in Automatic Blueprinter

THIS automatic, continuous blueprinter utilizes slip-free revolving contact between the print cylinder, tracings and print paper. The print cylinder, which revolves at the same rate as the feed and contact belts, is Pyrex glass and the quartz lamp light source, located inside the cylinder, is stationary. An aperture control, in the form of two metal flippers, is provided for governing the exposure area of the contact glass and makes it possible to give tracings of varying densities the proper exposure without changing machine speed. This control is adjustable by knob from the control panel.

A patented double chemical applicator makes possible the complete submersion of prints in chemical solution to assure thorough development and fixing. Either or both trays can be used with any combination of chemical or water, and squeegees remove excess chemical. Use is made of spray washes to speed up the washing operation and conserve floor space. Seven sprays loosen and rinse off excess coating chemicals after exposure and remove excess developer chemicals. Proper drying temperature is assured at all speeds by an interval timer which energizes a solenoid in the dryer contactor, turning the power on for the proper interval out

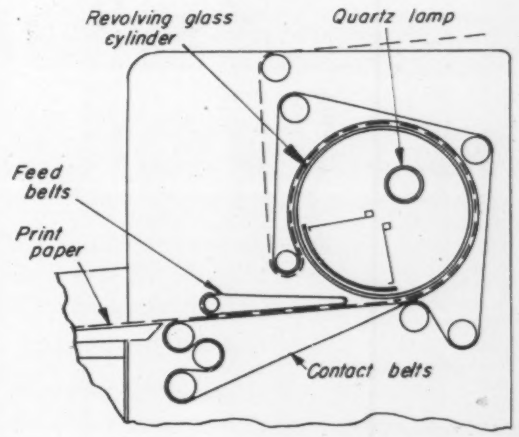

Anti-bleed tank
Squeegee bar
Squeegee bar
Wringer roller
Quartz lamp
Spray wash
Double chemical applicator
Contact belts
Aperture control
Revolving cylinder
Feed belts
Drying drums
Spray wash
Print paper
Drive roller
Pressure roller
Wind-up
Air dryer
Brake
Contact belt release pedal

CROSS SECTION THROUGH AUTOMATIC BLUEPRINTER



of every minute. Duct work and blower equipment for drying are concealed within the machine for improved appearance. Warm air exhausted from the printing chamber is piped back to the dryer to help in drying the prints.

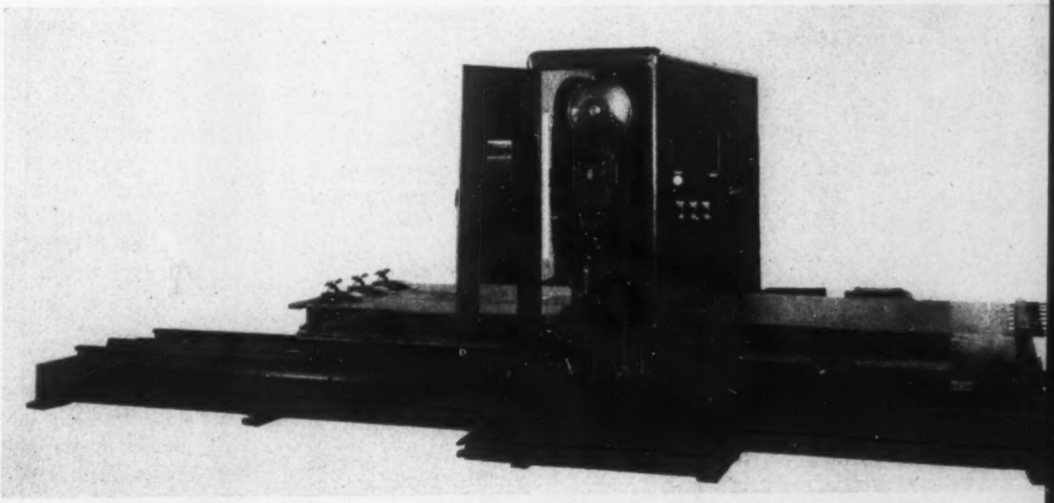
Control panel at right end of the feeding leaf carries the main contactor switch, lamp switch, dryer switch, heat-control interval timer, and aperture adjusting knob. Instrument panel at left carries the speed indicator and timer for recording hours of lamp operation. Entire unit is finished in gray wrinkle. Mfr: Paragon-Revolute Corp., Rochester 4, N. Y.

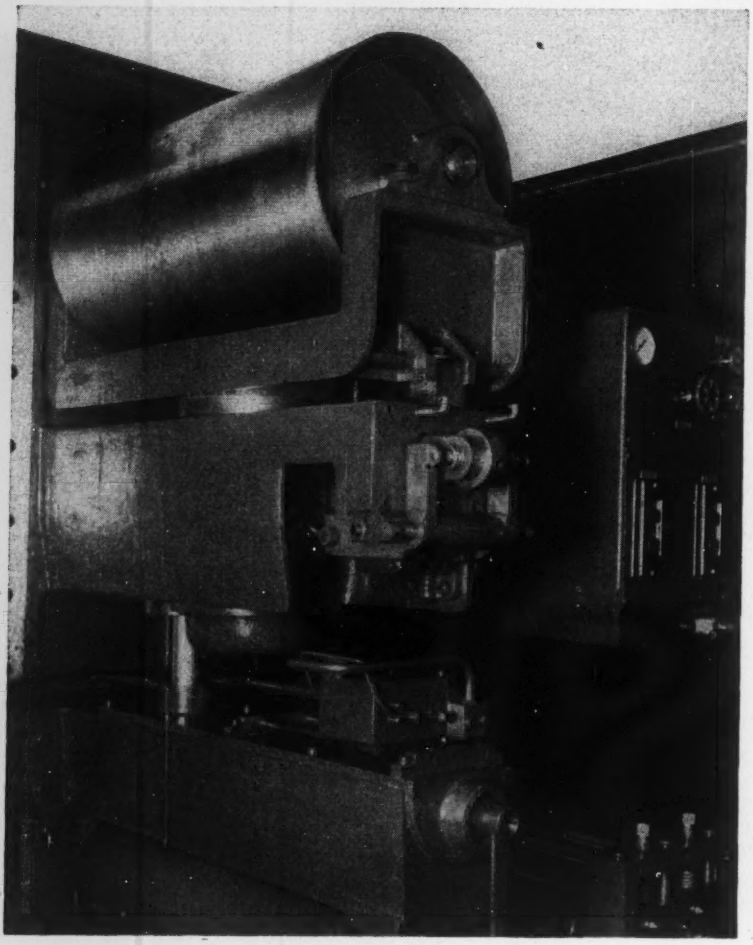


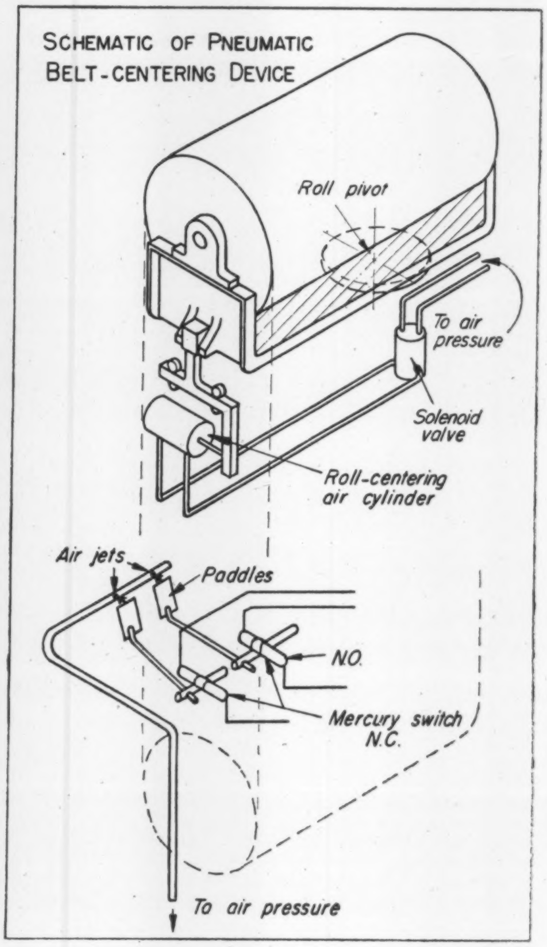
Exposure Unit of Blueprinter

Grinder-Polisher Centers Belt Pneumatically

Incorporated in this two-roll vertical abrasive-belt grinder and polisher is a pneumatic belt-centering mechanism shown schematically in the drawing, top right, next page. The two air jets impinge on paddles which pivot on shafts that also mount mercury switches. Edge of the abrasive belt rides between the two paddles. If the belt begins to ride off the ends of the rolls, both paddles will be shielded and, as the outer paddle drops it actuates its switch and energizes the solenoid air valve which controls air flow to the roll-centering air cylinder. Thus, as the belt rides off center one way or the other, it shields or exposes the paddles to the air jets and the subsequent motion of the paddle shafts actuates the mercury switches to energize the solenoid valve so as to move the air piston in the direction required for corrective pivoting of the upper roll. This centering





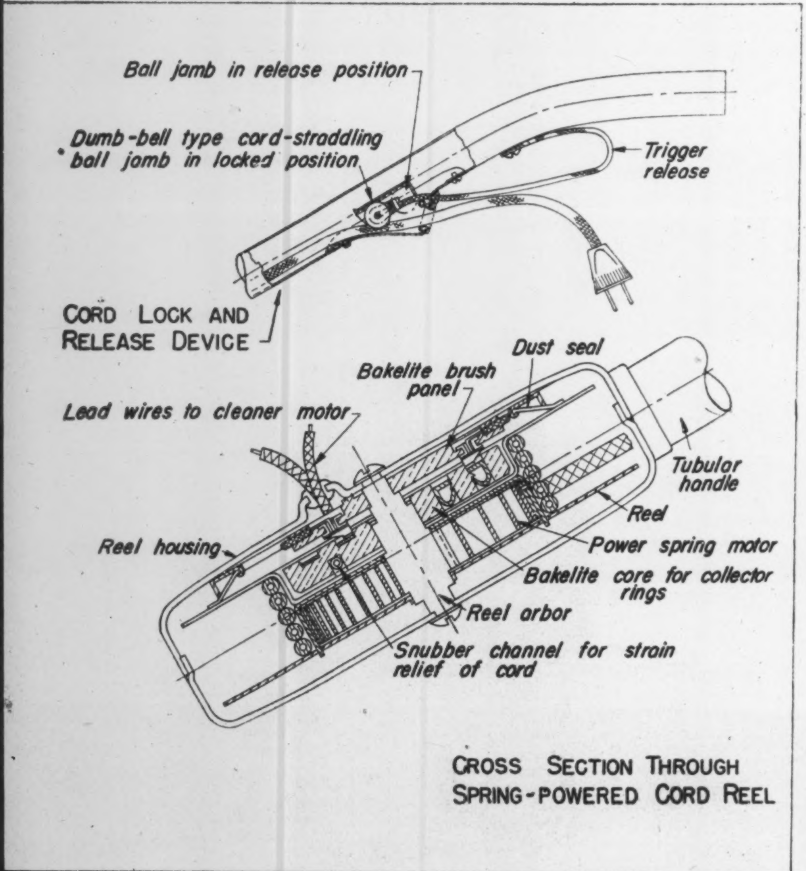


SCHEMATIC OF PNEUMATIC BELT-CENTERING DEVICE

Roll pivot
To air pressure
Solenoid valve
Roll-centering air cylinder
Air jets
Paddles
N.O.
Mercury switch N.C.
To air pressure

device requires a minimum of maintenance.

This machine is used for flat polishing of ferrous and nonferrous metals as well as other materials. The polishing head shown in the photographs employs an endless abrasive belt which rides over a dynamically balanced upper steel idler roll and a lower rubber-covered contact or work roll. The work roll, being the driving roll, eliminates slippage of the abrasive belt, thereby increasing belt life. Manufacturer: The Hill Acme Company, Cleveland 2.



CORD LOCK AND RELEASE DEVICE

CROSS SECTION THROUGH SPRING-POWERED CORD REEL

Ball jamb in release position
Dumb-bell type cord-straddling ball jamb in locked position
Trigger release
Dust seal
Bakelite brush panel
Lead wires to cleaner motor
Tubular handle
Reel
Reel housing
Power spring motor
Bakelite core for collector rings
Reel arbor
Snubber channel for strain relief of cord

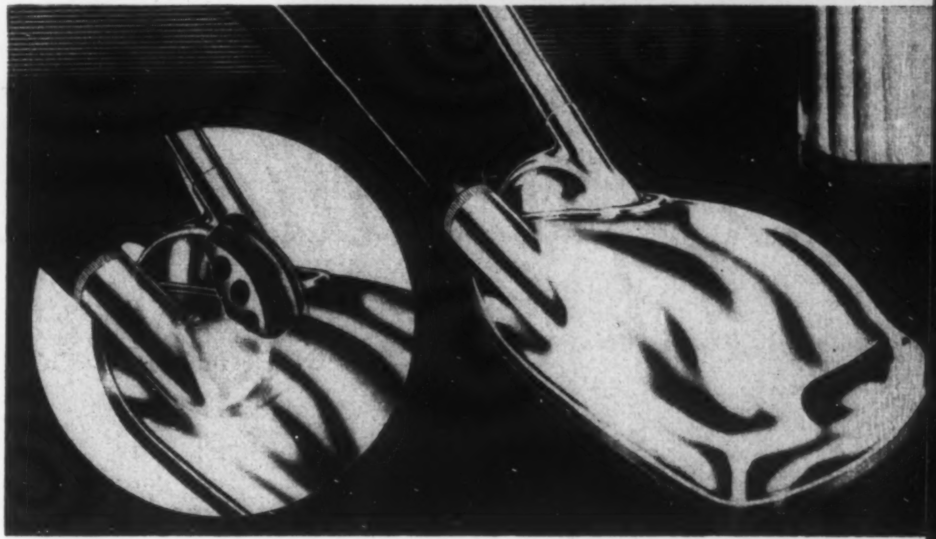
Reel Makes Vacuum Cleaner Cord Retractable

DESIGNED to eliminate the inconvenience of long loops of electric cord in the use of vacuum cleaners, the Cordomatic unit incorporates a spring-powered reel with current for the motor fed through collector rings and brushes.

Reel housing of the unit is made of two interfitted shallow drawn shells. As the cross section drawing, left, shows, the entire reel mechanism is enclosed in this housing, the Bakelite brush panel being equipped with two beryllium double-point silver contact brushes in contact with two brass silver-plated slip or collector rings molded into a Bakelite core which nests into a pocket in one side of the reel. A dust seal is provided on the electrical circuit face of the reel.

·hita City Lib..

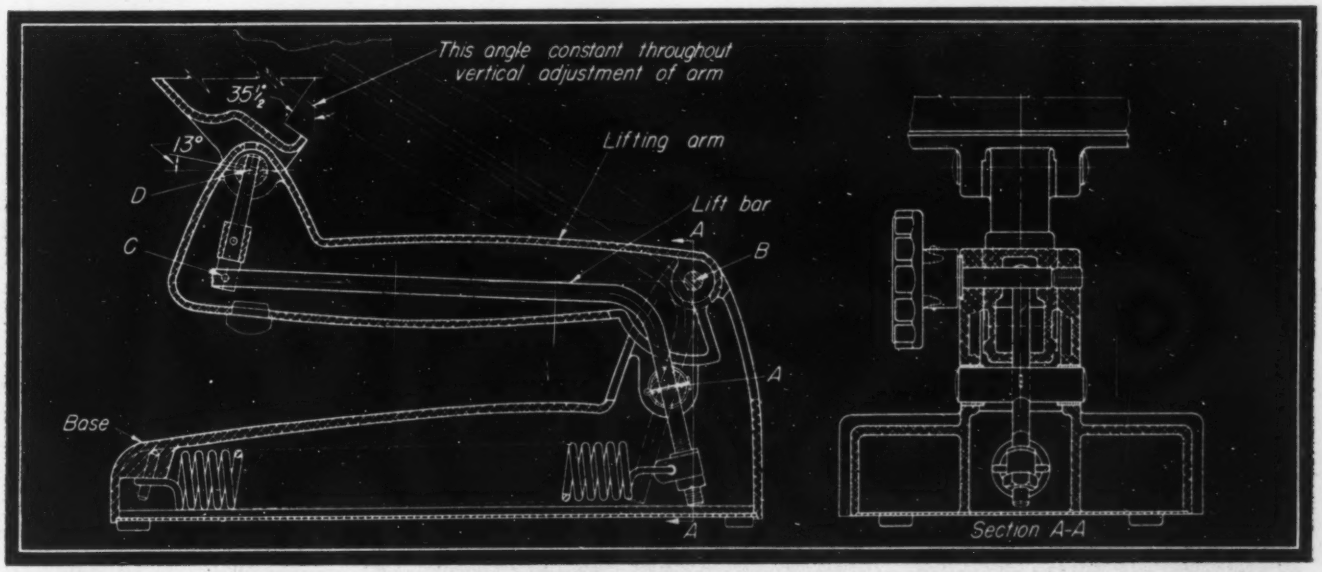
The electric cord travels from the reel up through the tubular handle and emerges at an angularly positioned cord outlet which is insulated by a well-rounded fiber grommet. This cord outlet is provided with a self-contained floating ball-jamb which is of dumb-bell formation and straddles the cord. As the cord is withdrawn, the ball-jamb is naturally lifted into the release position and, as the operator releases the cord, the slight retracting movement of the cord as it is pulled by the spring-powered reel automatically draws the ball-jamb down into the locked position. Complete rewind of the cord is effected by pulling on the ball-jamb trigger release. Manufacturer: Cordomatic Div. of The Vacuum Cleaner Corp. of America, Philadelphia 32.



Vision Testing Machine Employs Novel Counterbalance

DESIGNED to permit vision testing of as many as 100 persons in an eight-hour day, this "telebinocular" incorporates a built-in counterbalance which makes proper height setting of the testing head quick and easy. As the cross section drawing, below, shows, the counterbalance is essentially a spring-loaded parallelogram concealed within the hollow base and lifting arm. Points, A, B, C and D are the pivots of the parallelogram, the spacing of A and B being equal to that of C and D. Floating action of the head is made possible by matching the increasing moment arm of the head as it lowers with the increasing tension of the spring as it extends. Adjustment of spring pull is effected by moving the spring fitting on the end of the lift bar up or down by means of the nut shown.

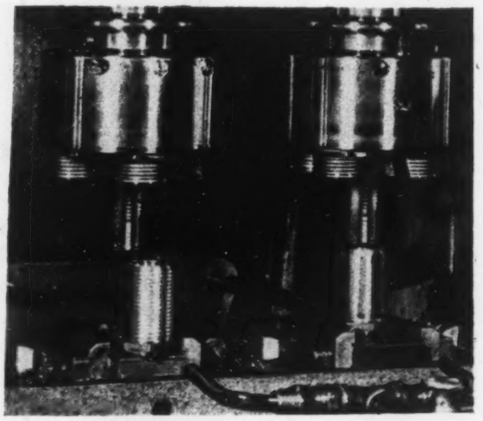
Top magazine of cards shown in the photograph is used for testing "far-point" vision, while the lower magazine of cards is for testing "near-point" vision. Tests check vertical alignment of eyes, acuity of each eye, stereopsis, horizontal alignment, and color perception. Machine was designed for Keystone View Co. of Meadville, Pa. by Mast Development Co. Inc. of Davenport, Iowa.



Applications

of engineering parts, materials and processes

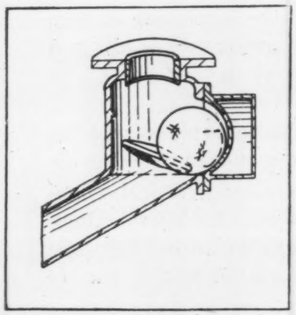
Simultaneous Internal-External Threading

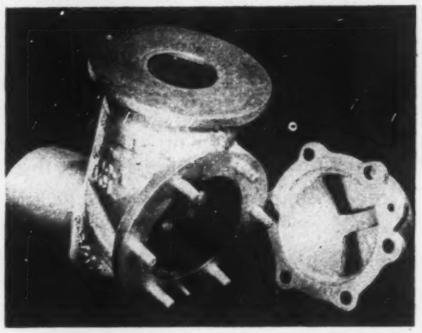


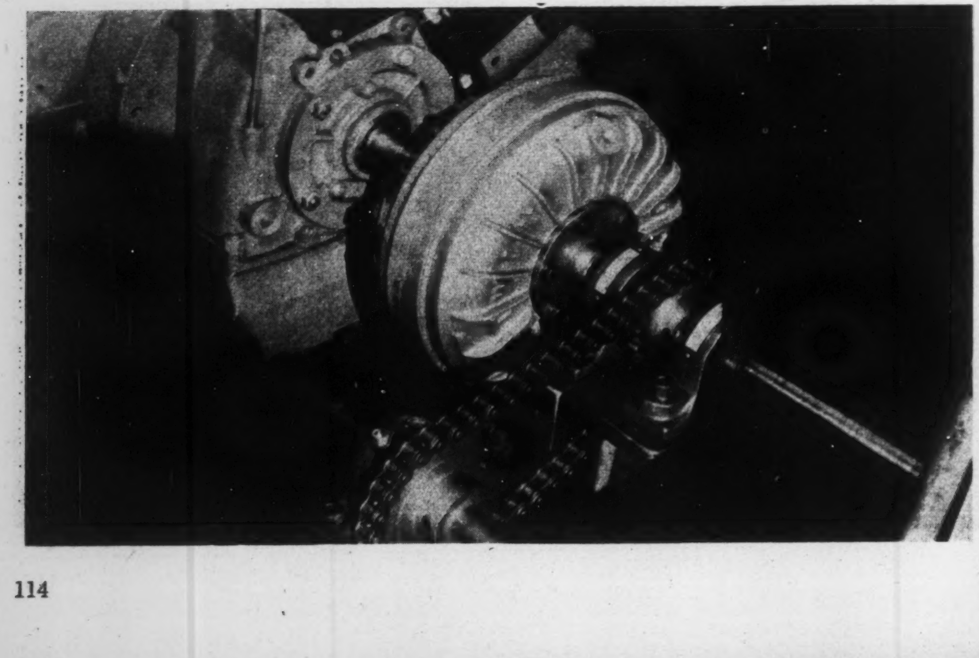
SIMULTANEOUS internal and external threading of large steel bushings is achieved on an Allen 10-spindle multiple drill press, close-up view of which is seen at right. Internal thread is machined with a tap having a pilot to assure correct alignment, while the external threads are cut with thread chasers revolving with the spindle. Material on which 11 pitch internal and external threads are being cut is SAE 1111 steel. In operation, bushings are slid into fixture hex-end down. Thrust of Detroit Tap and Tool company's M-11 alloy tap holds parts down and torque is taken on bushing hex.

Check Valve Has Neoprene-Covered Ball

RESILIENT NEOPRENE coating of check-valve ball, seen at right, resists attack by oil or corrosive fluids such as salt water. Valve was originally designed for ouboard drain line on boats, where good drainage is required to discharge waste, while back-flow of water into boat must be prevented. Swing-check designs rapidly became inoperative owing to clogging or corrosion. New design utilizes neoprene-covered cork ball which seats itself against upper port upon back flow. Under normal discharge conditions, ball rests against support shown unbolted in illustration, does not restrict flow.







Hydraulic Coupling Acts As Transmission

TAKING THE PLACE of the conventional clutch and transmission on a gasoline-engine powered invalid car, a 7.4-inch Twin-Disc clutch eliminates discomforting jerks on starting and accelerating the car. Clutch is placed between the six-hp air-cooled engine and chain drive to rear wheels. Use allows handicapped person to control vehicle with foot brake and throttle, requires only one foot for operation.

Plastics Molding Materials —Their Physical Properties

DATA covering the most important physical characteristics of the leading commercial molding materials are presented in convenient chart form for ready comparison on the following two pages. Each characteristic or property will vary in any given type of material, first, according to the exact formulation used, and second, according to some special conditions. Therefore, in the chart, the block in each column indicates the extreme practical range obtainable for each property.

In each case the method of testing employed has been clearly specified. The figures indicated on the chart are based on standard, medium-flow grades of each material, and represent the experience and data of the molding material manufacturers combined with that of Chicago Molded Products Corp. engineers and laboratory technicians. It will be noted that no attempt has been made to include in the chart such factors as colorability and resistance to chemicals, since these characteristics do not lend themselves readily to charting. They are discussed in the accompanying text.

Only those materials which are of commercial importance in making molded parts are included in the chart. Thus, materials which are used primarily in forms other than molded parts, such as sheet, or wire coating and insulation, are not included

EACH plastics material has certain characteristics, or qualities, peculiar to itself. Most materials have qualities which can be controlled, within limits, by varying the formulation. Raw materials have their own peculiarities of behavior when subject to certain special conditions. Thus, it would require several volumes to describe adequately the characteristics and behavior of the many plastics molding materials now in commercial use.

In the accompanying chart, therefore, there is presented a broad, general outline showing the properties of the molding materials of greatest commercial importance; this will be found of definite value for preliminary planning purposes. It is urged, however, that the final selection of the molding material be made only after consultation with competent and unprejudiced plastics engineers. Expert engineering assistance is one of the most valuable services rendered by custom molders.

One outstanding characteristic differentiates the various plastics materials—their reactions when subjected to heat. This leads to the classification of plastics materials into two groups—thermosetting (heat setting) and thermoplastics (heat softening).

Thermosetting Materials

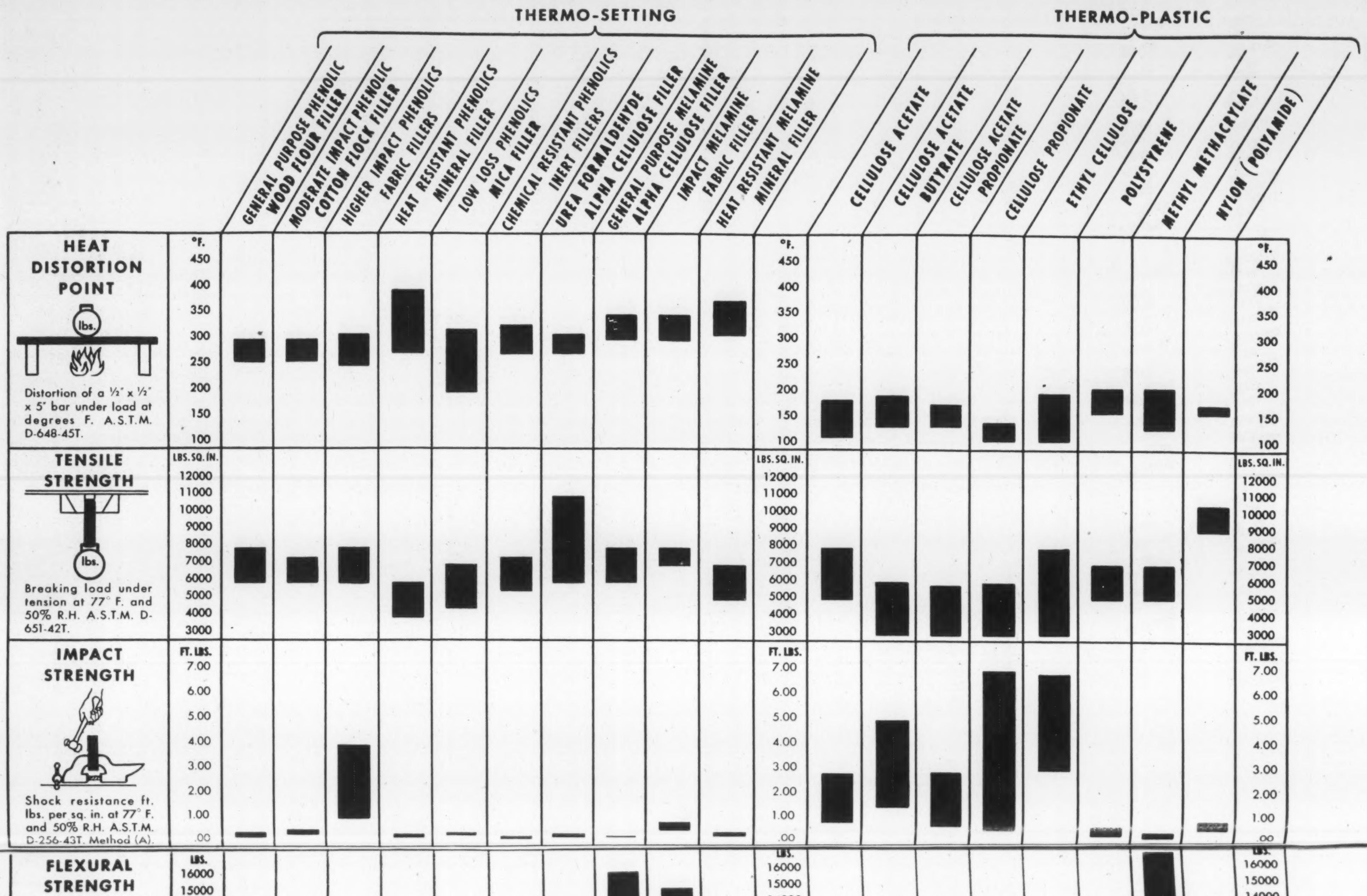
The thermosetting group is made up of those plastics materials which undergo a chemical change when heat is applied and become hard, insoluble, infusible parts which do not appreciably soften upon reapplication of heat. These products are formed in hot molds and removed while hot, after the rigid stage has been reached; they are commercially molded principally by the compression and transfer methods.

Phenol Formaldehydes: Popularly called the phenolics, these materials are often referred to as the "work-horse" plastics, because of their great range of commercial usefulness. They are characterized by good heat and electrical insulating properties, rigidity and strength. Molded parts have a hard surface and lustrous finish; moldability and machinability are excellent, and there is good moisture resistance and dimensional stability. Principal limitation is colorability; colors are limited to black, brown, and dark shades.

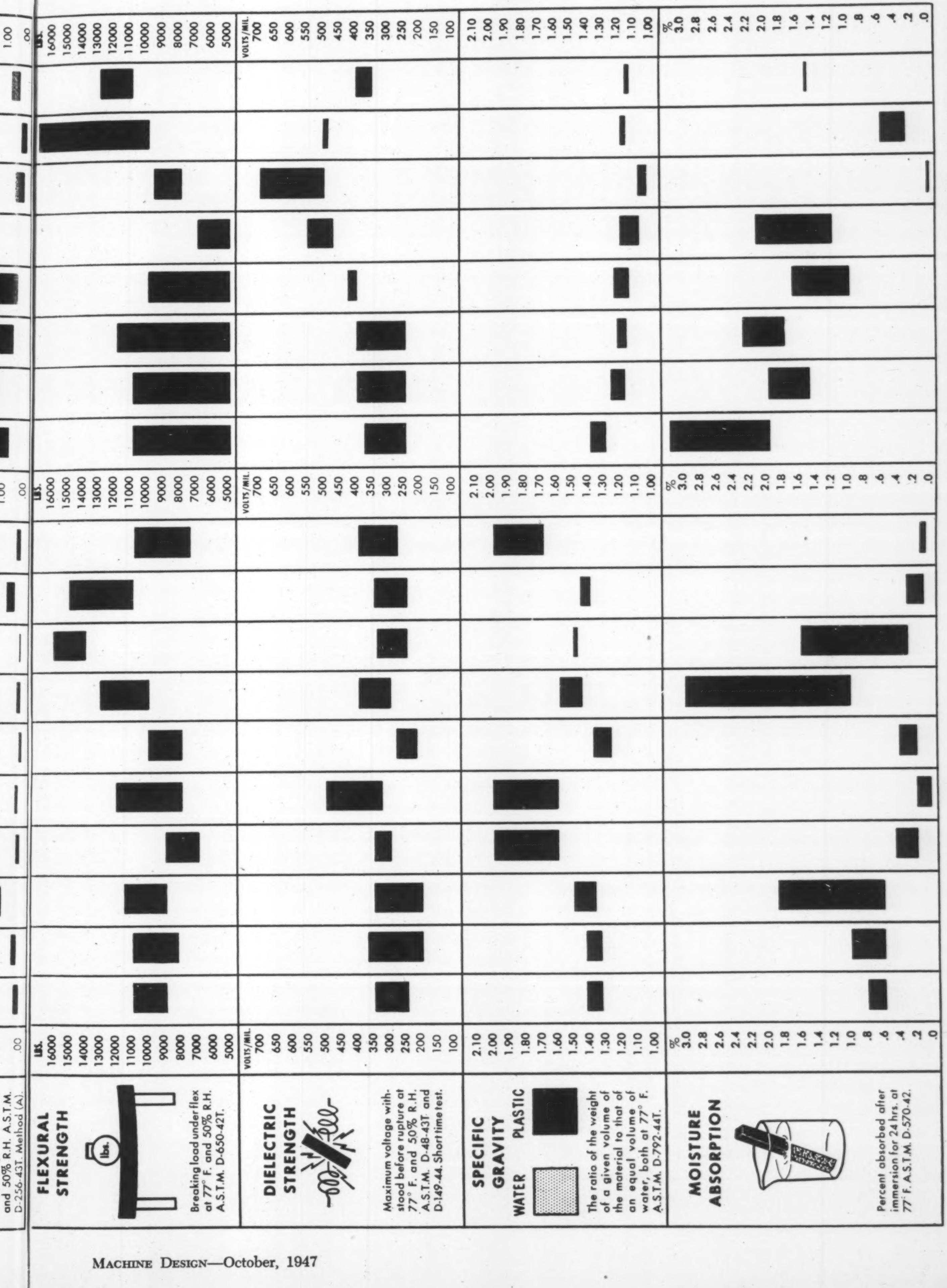
The phenolic resins, condensation products of phenol and formaldehyde, are modified by various types of filler to secure a wide range of physical and electrical properties. The most commonly used filler is wood flour. Wood-flour phenolics are characterized by good mechanical strength and electrical properties, plus ready moldability and excellent finish. Where improved mechanical strength with higher impact values are desired, cotton flock is employed as the filler. High-impact materials are obtained by the use of chopped cloth as the filler material. Where resistance to heat is desirable, mineral filler is employed, while mica fillers are used to secure special electrical properties in the molded material.

Urea Formaldehydes: The urea molding materials,

Comparative Physical Properties of Leading Plastics Molding Materials



ENGINEERING DATA SHEET



FLEXURAL STRENGTH

Breaking load under flex at 77° F. and 50% R.H. A.S.T.M. D-650-42T.

DIELECTRIC STRENGTH

Maximum voltage withstood before rupture at 77° F. and 50% R.H. A.S.T.M. D-48-43T and D-149-44. Short time test.

SPECIFIC GRAVITY

The ratio of the weight of a given volume of the material to that of an equal volume of water, both at 77° F. A.S.T.M. D-792-44T.

MOISTURE ABSORPTION

Percent absorbed after immersion for 24 hrs. at 77° F. A.S.T.M. D-570-42.

Copyright 1947, Chicago Molded Products Corporation, Reproduced by permission members of the thermosetting group, are primarily valuable for the fact that pastel shades and translucent colors can readily be produced. They are remarkable for their hardness, colorability, and for certain electrical properties, notably resistance to arcing and freedom from tracking. They possess good resistance to organic commercial solvents and to weak alkalis, but only fair resistance to weak acids. Ureas are produced principally with alpha cellulose fillers since they do not lend themselves readily to use with fillers of the extra-strength type.

Melamine Formaldehydes: The melamine materials are closely related to the ureas and possess similar characteristics including colorability. However, they maintain their properties over a substantially greater range of temperature, and have appreciably higher resistance to moisture and chemicals.

Because of these special properties, melamine materials are produced not only with the alpha cellulose filler, but also with cloth fillers for extra strength and mineral fillers for special electrical properties.

Thermoplastic Materials

Thermoplastics do not undergo a chemical change in molding as do the thermosetting materials, but merely soften under heat, take on a new form under pressure and retain that new form when chilled to a rigid state before the pressure is released. They can be softened again whenever a sufficient degree of heat is applied.

For the most part these materials do not include fillers. They are generally pure resins, having distinct characteristics which make them extremely valuable for many kinds of commercial applications.

They are, for example, tough and resilient. Nearly all have a wide range of colorability; they are available in clear, transparent forms, and in translucent or opaque colors. They possess excellent insulating qualities, are light in weight, and can be rapidly and economically molded by the injection method.

In this field, new and improved materials are constantly being presented, a fact which again emphasizes the importance of consulting the custom molder when selecting a plastics material.

Cellulose Group: This group is comprised of the following materials: Cellulose acetate, cellulose acetate butyrate, ethyl cellulose, cellulose acetate propionate, and cellulose propionate. The first three are old standbys of the plastics industry. Cellulose acetate propionate (Tenite III), and cellulose propionate (Forticel), are recent developments embodying improvements in certain characteristics over the older materials, and are considered to be of definite importance in the field of commercial molding.

The cellulosic plastics are characterized by their toughness, their colorability, and their adaptability to a wide range of valuable commercial applications. Cellulose acetate butyrate was developed to yield greater moisture resistance, and better dimensional stability than cellulose acetate. It is, however, characterized by a slight odor which is objectionable in certain applications. Cellulose acetate propionate has approximately the same characteristics as butyrate, but is virtually free from odor. Cellulose propionate has excellent dimensional stability, lustrous finish and low moisture absorption. Ethyl cellulose has the lowest moisture absorption among the cellulosics and in addition is remarkable for its flexibility and toughness at low temperatures.

Polystyrenes: The various formulations of polystyrene are characterized by outstanding electrical properties and are highly resistant to most acids and alkalis. They are however, attacked by chlorinated hydrocarbons, and some essential oils. They are outstanding for their stability and almost negligible moisture absorption. Because of their rigidity, the polystyrenes lack the impact values found in the cellulosics. Recent developments have produced polystyrenes with relatively high heat-distortion points; these materials are recommended for use where temperatures approach that of boiling water. Various other modifications of polystyrene have been produced for use in special applications.

Methyl Methacrylate: This material is noted for its unsurpassed optical clarity, and its unique ability to conduct light from one edge to another. Its heat distortion point is one of the highest among the thermoplastics, and its electrical properties are good.

Unique Properties of Nylon

Nylon (Polyamides): Nylon is one of the later plastics, having come into existence as a molding compound just before World War II. Because of its unique properties it differs substantially from other plastics materials in many respects. Outstanding among its advantages are extreme toughness, relatively high heat resistance, and inertness to the great majority of commercial solvents. It is important to note, however, that this last mentioned quality places, for the present at least, very definite limitations on its colorability. The natural color of the material is somewhere between a light tan and ivory.

In contrast to other thermoplastics, nylon does not soften gradually as the temperature is increased; instead, it has a relatively sharp melting point. When heated into the plastic state, this resin has a low viscosity so that it can be readily molded into tough, thin sections.

In general, the electrical properties of nylon do not compare favorably with those of other plastics materials. The moisture absorption properties are rather unique, and should therefore be carefully analyzed in any application where moisture resistance is a factor.

Nylon's toughness and resistance to abrasion make it an excellent material for applications such as bearings, small gears and other parts of a similar nature.

Assets to a Bookcase

Developing Marketable Products and Their Packaging

By Ben Nash, product development consultant; published by the McGraw-Hill Book Co., New York; 404 pages, 5¾ by 8¾ inches, clothbound; available through MACHINE DESIGN, *$6.00 postpaid.*

Guide to the development of machines and products that will find ready market acceptance, this book treats development from the day of its conception to the time of ultimate obsolescence. The author analyzes the many considerations in design and development which influence the marketing success of mass-production items. He outlines and discusses twenty-two factors, the proper handling of which will improve salability. Of these, nineteen require the close attention of the engineer and designer.

Since it is obviously impossible to consider in one volume the problems confronting every designer, giving particularized rules and procedures, only underlying principles adaptable to the varying demands of manufacturers are presented. These are supported in many instances by case histories of actual developments in which the author participated. The volume is replete with tables, charts and illustrations. It has an excellent section on color in which the Munsell color system, a process for the evaluation of color and color combinations, is presented.

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1947 Modern Plastics Encyclopedia

Published in three volumes by the Plastics Catalogue Corp., New York; 1400 pages, 9 by 12 inches, clothbound; available through MACHINE DESIGN, *$8.50 postpaid.*

Increasing scope of the plastics industry is reflected in the great increase in size of the Modern Plastics Encyclopedia. Previously printed as one volume, this reference work has now been published within three covers to facilitate handling. Each of the first two volumes are approximately equal in size to single previous editions. The third volume, presents the Modern Plastics charts in convenient folder form.

Volume I of the encyclopedia is devoted entirely to plastics materials, dividing them into five categories. These are: General compounds. coatings and films, fibers and fabrics, laminates and vulcanized fiber, resin-wood products. Much of the information is either entirely new or rewritten to bring it up to date. For example, new sections have been added to cover alkyd resins as well as polytetrafluorethylene, while the section on rubber has been reorganized to cover synthetic rubbers and natural rubber derivatives.

Volume II, dealing with design and manufacture of plastics parts has had four divisions entirely rewritten and brought up to date. This section now covers: Design, molding-extruding-casting, fabricating-finishing-assembly, and machinery and equipment. A portion at the rear of the volume presents valuable information to the designer in the shape of a bibliography, a glossary of terms and directories of manufacturers and processors.

Volume III, containing the charts presents the earlier valuable tabulations, with the addition of new ones on fibers and low-pressure laminating resins. In all, ten charts in removable form are contained in this section.

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Concise Chemical and Technical Dictionary

Edited by H. Bennett, Technical Director, Glyco Products, Inc.; published by the Chemical Publishing Co. Inc., Brooklyn, N. Y.; 1120 pages, 6 by 9 inches, clothbound; available through MACHINE DESIGN, *$10.00 postpaid.*

Nonexistance of a complete technical dictionary is a condition that has troubled all technical writers and most engineers to varying degrees. The dictionary, with its 50,000 definitions, should go far toward remedying this situation. Concise, clear and to the point, the nomenclature in the book is that generally adopted by engineers. So that desired terms can be located with a minimum of effort, thousands of helpful cross references have been included and carefully arranged, while a special feature is the up-to-date inclusion of many trade names and proprietary products.

While, as the name indicates, the dictionary is somewhat heavy on the chemical side of engineering, a careful examination tends to indicate that mechanical and electric terms seem few only because of the tremendous multitude of chemical terms possible. One must go far to discover a more complete dictionary in the technical field.

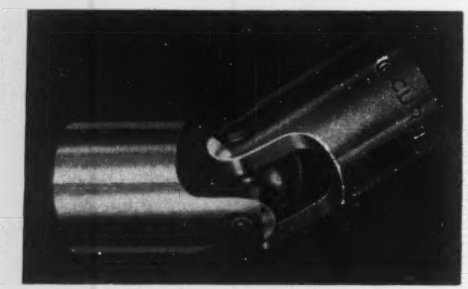
Latest revision of the Resistance Welding Manual, first published in 1943, has virtually doubled the size of the volume. Twenty new chapters have been added and tables of procedures have been revised to bring them up to date. In this edition, mechanical and electrical characteristics of both conventional ac and stored-energy systems are treated in detail, while large additions to the discussions of electrical controls and power supply have been made. New chapters include information on quality control, instrumentation and testing and a glossary of definitions has been added. The clothbound, 552-page book measures 6 by 9 inches and is available at $3.00 from the Resistance Welder Mfr.'s Assoc., 505 Arch St., Philadelphia 9.

new parts and materials

To obtain additional information on these new developments see Page 363

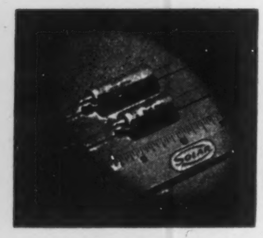
Ball-Type Universal Joint

LOW-FRICTION universal joint requiring no boots or covers is recommended for light loads at high speeds. The joint consists of two steel forks bearing on a bronze ball having heat-treated centerless-ground pivot bearing pins. The larger pivot pin is provided with an oiler which transmits lubricant to all bearing points. Ball surface offers a minimum of friction loss, insuring long life. Two sizes of joint are now available: Shaft sizes ½ and ¾-inch. Larger sizes will be available shortly. Manufacturer: Curtis Universal Joint Co. Inc., Dept. D, Birnie Ave., Springfield 7, Mass.



For further information circle MD 1 on card Page 363

Electrolytic Capacitors



DRY ELECTROLYTIC capacitors of small size are available in ratings from 8 to 300 mf. The type LB condensers for low-ripple service have 3/8 by 1 1/8-inch containers in sizes from 8 to 200 mf, and are 3/8 by 1 5/8 inch in capacities ranging from 12 to 300 mf. Maximum ac ripple voltage which may be applied to capacitors rated at one wvdc and greater is 7 volts at 60 cycles ac or 3.5 volts at 120 cycles. Manufacturer: Solar Mfg. Corp., 285 Madison Ave., New York 17.

For further information circle MD 2 on card Page 363

Roller Follower

SUCCESSFULLY USED in such applications as lift trucks, circuit breakers and textile machinery for a number of years but heretofore only made to special order, the RBC roller follower is now available as a standard series bearing. The follower has a heavy-walled one-piece channel-shaped guiding race with a single row of small-diameter rollers retained by the outer race. The outer race is SAE 3615 steel which is carburized, providing a hard surface on which the cam and rollers can ride, yet maintaining a resilient core to absorb any impact loads. Standard inner races are available for the entire series for use in applications where it is undesirable or impractical to harden and grind the shaft upon which the roller-follower will ride. Manufacturer: Roller Bearing Co. of America, Whitehead Road, Trenton 3, N. J.

For further information circle MD 3 on card Page 363

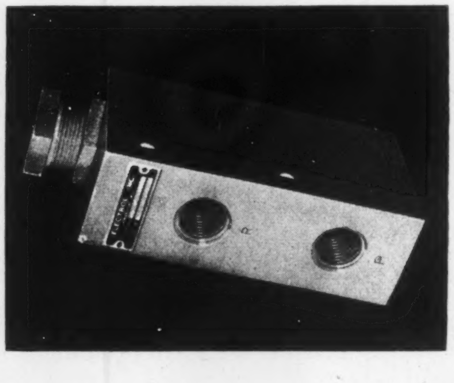
Heavy-Duty Appliance Switch

HEAVY-DUTY APPLIANCE SWITCH capable of carrying up to 2500 watts has a miniature neon lamp visible from three directions which serves as a warning glow-light indicating that the current is on. The switch is a double-pole single-throw type, thus breaking both sides of power line and reducing the possibility of current leakage. Unit has a one year warranty and is manufactured by Trilmont Products Co., Philadelphia.

For further information circle MD 4 on card Page 363

Hydraulic Relief Valve

RELIEF VALVE for use with oil pressure systems features cracking pressure up to 90 per cent of full-flow pressure and reseat pressure as much as 85 per cent of full-flow pressure. Units are available in two models. Model 523-8, measuring 1⅜ by 2 by 5 inches, has ports tapped ⅜-18 NPT and will pass six gpm maximum in a pressure range 500 to 2100 psi. Model 523-14 measures 2⅜ by 3¼ by 8½ inches and will pass 16 gpm through its ¾-14 NPT ports at pressures from 500 to 2100 psi. Both units are of 17 ST aluminum, with poppet valve and seat of hardened and ground steel. Valves feature use of dampening device consisting of a close-fitting piston which



prevents squealing or chattering. Both models may be adapted for use in water circuits. Manufacturer: Electrol, Inc., 85 Grand St., Kingston, N. Y.

For further information circle MD 5 on card Page 363

Locking Fastener

LOCKNUT USING NYLON as the locking element, is said to make possible 220 removals without reducing torque below Army-Navy specification value. Nut uses metal as the strength-providing portion, having Nylon collar which presses into bolt threads and resists loosening vibration. Manufacturer: The Nylok Corp., 475 Fifth Ave., New York 17.

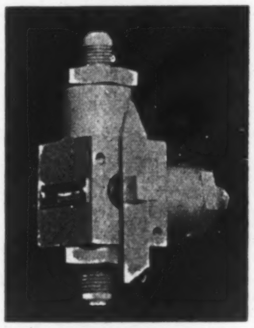
For further information circle MD 6 on card Page 363

Oil-Pressure Alarm

FAILURE of any part of a lubrication system in such a manner as to allow pressure to fall below a preset value is detected by the Oiltrol pressure-activated safety device. Danger signals or emergency controls of any desired type may be activated by the detecting unit. Sturdily constructed of extruded aluminum, Oiltrol is of simple and compact design. Lubrication-system design requires only the addition of a spur line to the switch. Manufacturer: Oiltrol Co., 2550 15th St., Denver 11.

For further information circle MD 7 on card Page 363

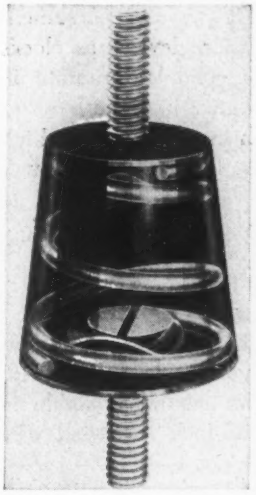
Fuel-Tank Selector Valve



POSITIVE-POSITION, positive-sealing fuel tank selector valve is usable with air, water and oil as well as gasoline. Designated as model 544, the valve assures positive positions of the control handle by means of built-in detents. Poppet-type valve design assures free operation, low pressure drop and eliminates sticking. There are four handle positions: Tank No. 1 on, both tanks on, tank No. 2 on, and both tanks off. Unit has light weight housing of anodized aluminum and port sizes may be varied to suit design requirements. Manufacturer: Electrol Inc., Kingston, N. Y.

For further information circle MD 8 on card Page 363

Vibration Mount with Integral Spring

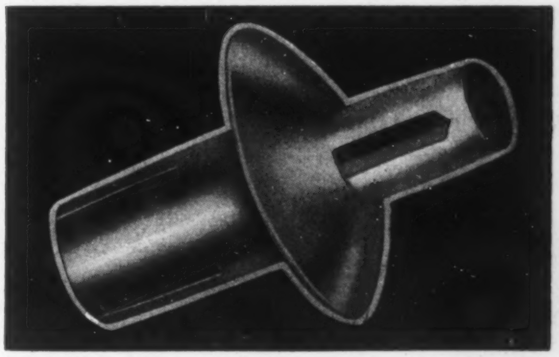


EXCELLENT HORIZONTAL stability of type RS conical rubber-spring mounting provides smooth operation and is said to frequently eliminate the necessity for snubbers. Utilizing a combination of rubber and a helical steel spring, the new type mount has a wide frequency isolation range and a high load capacity, ranging from 25 to 125 lb for the models now available. The mount, which is designed primarily for use on compressor units, generator sets, pumps, fans, etc.; is equally effective for pumps operating at 1750 rpm and compressors running at 450 rpm. Manufacturer: The Korfund Co. Inc., 48-17 Thirty-Second Place, Long Island City, N. Y.

For further information circle MD 9 on card Page 363

Light-Metal Blind Fastener

IMPACT-FASTENING blind rivet, the Southco rivet is driven by striking an expanding pin and driving it flush with the rivet head. Available in 3/16 and 1/4-inch diameters with lengths from 1/8 to 1/2-inch in increments of 1/32-inch the fasteners are made of aluminum. They are especially suitable for attaching aluminum sheets to supports and may be driven in either blind or accessible locations without the need of special tools. Manufacturer: South Chester Corp., 1418 South Penn Square, Philadelphia 2.



For further information circle MD 10 on card Page 363

High-Temperature Silicone Lubricant

LUBRICANTS capable of excellent service in the temperature range 10 F to 500 F, new Silicone oil series has unusual heat stability and high resistance to oxidation. Series includes oils numbered: DC-710, DC-710G and DC-710R. Oils are also recommended for high-temperature baths, or service as hydraulic fluid where high temperatures are involved. Two of the DC 710 oils are especially designed for high-temperature lubrication: Type R contains a corrosion inhibitor and provides permanent lubrication for such sealed-in precision devices as clocks and instruments; type G contains colloidal graphite in suspension and is useful for lubricating mechanisms continually exposed to extreme heat, weather or high humidity. Manufacturer: Dow Corning Corp., Midland, Mich.

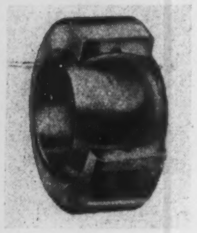
For further information circle MD 11 on card Page 363

Nylon Covered Steel Cable

UNUSUAL WEARING QUALITIES of new Nylon-covered cable make it particularly suitable for applications where repeated flexing occurs. Now available in 6/32 and 7/32-inch sizes with 3/32-inch aero-steel wire core, the Danco cable is highly resistant to oils, acids, moisture, salt water, friction and fire. It will not rust or rot. Rated at 920-lb break test, the cable has withstood 820,000 flexings over one-inch pulleys before core failure. Nylon covering requires 410,000 flexings before failure. Manufacturer: Danielson Mfg. Co., Danielson, Conn.

For further information circle MD 12 on card Page 363

Spherical Self-Aligning Bearing

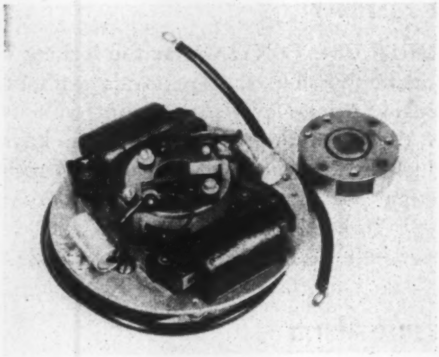


TWO PIECE spherical bearing has wide surface-area permitting heavy loading under misalignment conditions. The Halfco bearing consists of a hard-bronze outer race integrally formed around a hardened, highly-polished, precision-ground steel ball. Special units of other metals are made to specification. A low-cost bearing because of its simplicity of design, it is adaptable to such applications as rod-end bearings and self-aligning bushings. Manufacturer: Adel Precision Products Corp., 10777 Van Owen St., Burbank, Calif.

For further information circle MD 13 on card Page 363

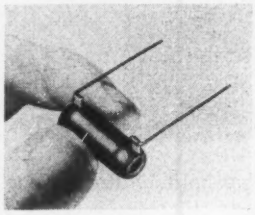
Direct-Driven Magnetos

STURDILY BUILT to suit either one or two- cylinder engines, the K-Magneto is applicable to industrial, automotive and marine engines. In either the model K2-A for two-cylinder engines or K1-1 for single-cylinder engines, this magneto is built around an aluminum die-cast frame to which the individual components are securely fastened. Utilizing rotor poles of Alnico, the unit will generate voltages as high as 11,500, and will produce adequate high-tension sparks at low cranking speeds. Under normal operating conditions, rain and spray will not affect the magneto's performance. Manufacturer: Scintilla Magneto Div., Bendix Aviation Corp., Sidney, N. Y.



For further information circle MD 14 on card Page 363

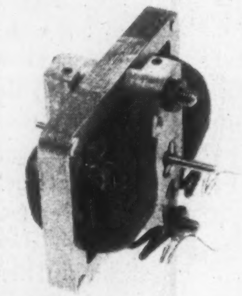
Enameled Wire-Wound Resistors



VITREOUS - ENAMELED, wire-wound resistors in the 5-watt size have been added to the Brown Devil line of 10 and 20-watt resistors. The 5/16 by 1-inch resistors may now be obtained from stock in resistance values from 1 to 10,000 ohms with standard tolerances of 10%. They are of all-welded construction and have 1½-inch copper-wire leads. Manufacturer: Ohmite Manufacturing Co., 4952 Flourney St., Chicago.

For further information circle MD 15 on card Page 363

Shaded-Pole Induction Motor

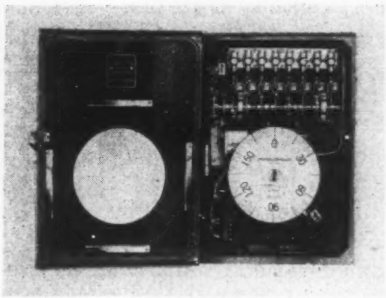


SINGLE-PHASE, shaded-pole motor of four-pole type, the B-30-A fractional-horsepower motor operates under substantially constant power input from no-load to blocked-rotor condition. Unit may therefore be used in operations where load is driven against a stop. It may there remain energized without being overheated. For continuous-duty service, winding is designed so that temperature rise does not exceed 90 C; for duty cycle of about ten minutes per hour, coils can be adjusted to give relatively high torque and large power output. Nonreversible, the motor may be assembled for either clockwise or counterclockwise operation, or two units may be mounted back-to-back for reversible operation and dynamic braking. Standard motor is wound for 24-volt, 60-cycle power, but is available in other ratings. It has 3/16-inch diameter shaft mounted in porous-bronze bearings. Manufacturer: Gleason-Avery, Inc., 29 Clark St., Auburn, N. Y.

For further information circle MD 16 on card Page 363

Time Cycle Controller

MULTIPLE-CAM time-cycle controller known as the Model C500 Impulse-Sequence Cycle Controller is designed for use on production processes where a number of factors must be accurately timed to a fixed program. Telechron-timed, the controller operates by means of an aluminum disk driven by the timing motor. Notches cut in the edge of the disk determine the time of operation of a cam mechanism, controlling a pilot valve, for a given operation. Eight of these cam-valve assemblies permit control of a variety of simultaneous mechanisms or processes. Time measurement and pilot-valve operation are handled by separate mechanisms. Separation of the two basic functions makes possible a design which gives accurate timing of the factors under control, while at the same time provides high speed and torque for pilot valve operation. Manufacturer: The Bristol Co., Waterbury 91, Conn.



For further information circle MD 17 on card Page 363

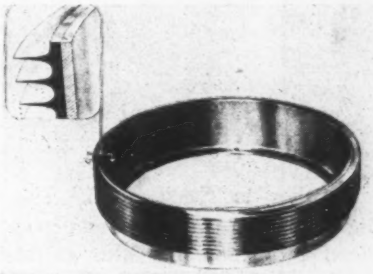
High-Strength Alloy

HAVING A DENSITY and hardness approaching tungsten, Mallory 1000 metal, a new powder-metal alloy, is easily machineable. The sintered metal is resistant to atmospheric corrosion and certain acids, is widely used in balancing rotors. Outstanding properties include modulus of elasticity in the range 20-40 million psi, and low permeability with respect to gamma radiation. Manufacturer: P. R. Mallory & Co. Inc., 3029 E. Washington St., Indianapolis 6.

For further information circle MD 18 on card Page 363

Metallic Brake Drum

BRAKE DRUM suitable for all types of vehicular applications is of unusual design. Friction surface is special wear-resisting steel while outside layer is copper with specially designed fins. Unit dissipates friction-generated heat rapidly while helping to maintain a uniform temperature level over the entire drum surface. Among advantages claimed for new development are little heat checking, no cracking, reduced wear and freedom from distortion. Manufacturer: Copperweld Steel Co., Glassport, Pa.



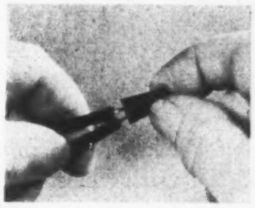
For further information circle MD 19 on card Page 363

Electrode for Light-Gage Welding

HIGH-SPEED heavy-coated electrode for all position welding on light-gage mild steel, welds with a minimum build-up and produces a bead contour requiring little finish grinding. The SW-16 electrode is useful in a wide variety of fabricated assemblies including automotive equipment, stoves, refrigerators, tanks, etc. Manufacturer: The A. O. Smith Corp., Milwaukee.

For further information circle MD 20 on card Page 363

Solderless Wire Connectors

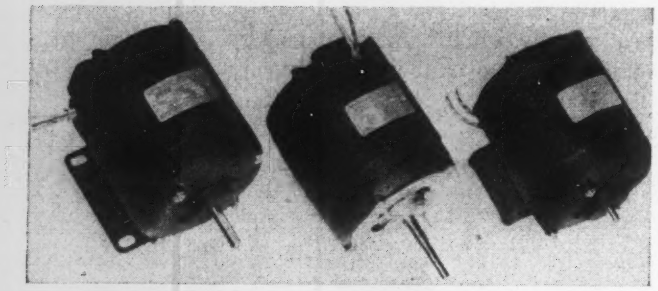


PERMANENT electrical connectors, requiring no tape or solder, screw directly onto stripped conductors. Termed Scru-Its, the hot-molded Bakelite connectors are unaffected by heat, cold or moisture, and are manufactured in several sizes for connecting various combinations of solid and stranded wire. In use, wire ends are stripped and the Scru-Its attached, no twisting of wires being necessary. Small size permits use within switch boxes, appliances etc. Manufacturer: Solar Electric Corp., Warren, Pa.

For further information circle MD 21 on card Page 363

Fractional-Horsepower Motors

PRECISION MOTORS in a single line are available as synchronous, induction, spit-phase, capacitor, or three-phase types. As synchronous motors they are rated 1/20-hp at 1800 rpm; as induction motors at 1/10-hp at 1700 rpm, both functioning on 115-volt, 60-cycle power. Ratings vary for other types of windings and power supplies. Motors measure 4⅜ inches in diameter and are 5⅞ inches long exclusive of shaft. They are internal fan cooled. Housing and end brackets are cast aluminum with wrinkle

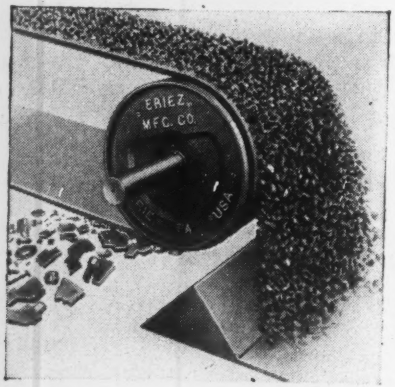


finish; other finishes to specification. The ball-bearing base-mounting motors are available with automatic-reset thermal-overload protection and also as totally enclosed units at reduced ratings. Manufacturer: Electric Indicator Co., Stamford, Conn.

For further information circle MD 22 on card Page 363

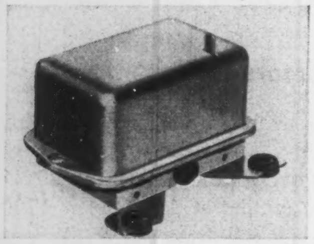
Magnetic Pulley

PERMANENT-MAGNET powered, and thus not requiring external sources of energy, new pulley will efficiently separate magnetic from nonmagnetic materials. Utilizing large magnets, the pulley is recommended for applications where severe temperature changes and unusual operating conditions preclude the use of electrical power. Advantages include continuous operation at top efficiency and little need of maintenance. Manufacturer: Eriez Manufacturing Co., 2690 E. 12th St., Erie, Pa.



For further information circle MD 23 on card Page 363

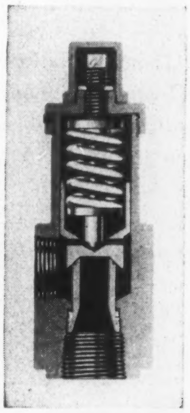
Vending-Machine Relay



COMBINATION vending and "antijackpot" relay is a single unit incorporating two separate relays within one inclosure. The vending relay is a general-purpose type having a single-pole, normally-open contact and a single-pole, double-throw contact. This relay, which controls the vending motor and coin solenoid, is of the 3-wire control or electrical hold-in type. The "antijackpot" relay is electrically held and mechanically latched in the energized position. Suitable contacts are provided to deenergize the vending circuit and energize the "sold-out" lamp in the event that the coin switch is closed at the instant an article is ejected from the machine. Housing is a gasketed, drawn-steel standard automotive type enclosure. Manufacturer: R-B-M Div., Essex Wire Corp., Logansport, Indiana.

For further information circle MD 24 on card Page 363

Safety Relief Valve

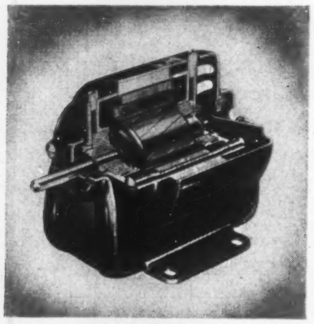


VERSATILE safety relief valve for pressures up to 10,000 psi is available in steel, bronze, or stainless, with disk and nozzle of stainless steel. Available in three body sizes, 1/2, 3/4, and 1 inch, the valve has interchangeable nozzle inserts for proper capacity at set pressure in three ranges—2000, 5000 and 10,000 psi—for each size. High flow efficiency with a coefficient approximating unity is obtained by means of the high lift of the disk brought about by the high kinetic energy of discharge developed by the nozzle. Unit, known as model 2745, has top-guided disk piston with its two-point bearing surface completely free acting. Nozzle seat is well above the drain line, hence remains dry and is not subject to accumulations of scale and sediment. Manufacturer: Farris Engineering Corp., 524 Commercial Ave., Palisades Park, N. J.

For further information circle MD 25 on card Page 363

Fractional-Horsepower Motor

SHADED-POLE motor of the 4-pole type is rated at 1/20-hp. A totally-enclosed ac motor, it is designed for continuous duty at 1500 rpm and is sold under the trade name, Micromotor. These new units have 2 square inches of bearing surface, and 6 cubic inches total oil-reservoir volume. Circulating lubrication is said to permit continuous operation in any position for unlimited periods. Other features include: Silent thrust washers, flush-weld-

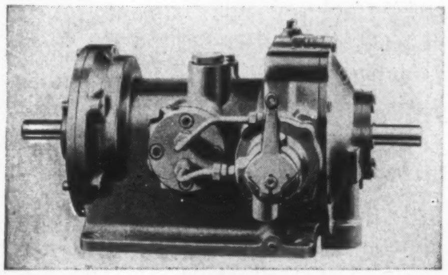


ed, precision-skewed rotor, humidity and oil resistant windings, controlled end-play and 198 square-inches of cooling surface. Manufacturer: Redmond Co. Inc., Owosso, Mich.

For further information circle MD 26 on card Page 363

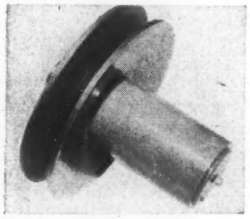
Hydraulic Variable-Speed Transmission

VARIABLE-SPEED reversible power transmission weighing only 90 pounds is capable of producing 135 lb-in. of peak torque. The type AHB-33 transmission consists of a variable-delivery radial rolling-piston pump driving a constant-displacement radial rolling-piston motor. It is available with hand screw control, lever control and two-speed control. Electric three-position remote control also can be furnished to obtain independently adjustable preset speeds in either direction as well as neutral or idle position. Operating with 1750-rpm input speed, the unit will produce output speeds variable up to 1600 rpm and with normal torque of 90 lb-in. Starting torque available is 125 lb-in. Uniform acceleration from zero to maximum, virtually unaffected by variations in load is said to be obtainable. Manufacturer: The Oilgear Co., 1301 W. Bruce St., Milwaukee 4.



For further information circle MD 27 on card Page 363

Variable-Pitch Pulleys



LINE OF variable-pitch pulleys providing a 3:1 speed ratio will transmit up to 2 hp at 1750 rpm. The pulleys maintain a constant center line and thus may be used with a V-groove companion sheave. They are suited for use on vertical as well as horizontal shaft mountings. Large key area provided on units is said to result in longer equipment life and quieter operation. Manufacturer: Gerbing Mfg. Corp., 154 E. Erie St., Chicago 11.

For further information circle MD 28 on card Page 363

Electronic Counter

FOOL-PROOF counter device for counting work strokes of machines records total strokes, time required, and strokes per unit time on remotely-located recording mechanism. Since machine records actual work done rather than a motion of a mechanism part, false readings can not be introduced either by design or error. Unit is controlled by electronic trigger tube in machine power line which actuates the counter circuit only when power consumption of machine exceeds given value. Thus, nonwork stroke will not record on counter. The instrument is applicable to any electrically-powered machine. Manufacturer: Lansing Engineering Co., 934 Clark St., Lansing 6, Mich.

For further information circle MD 29 on card Page 363

New Carburizing Steels

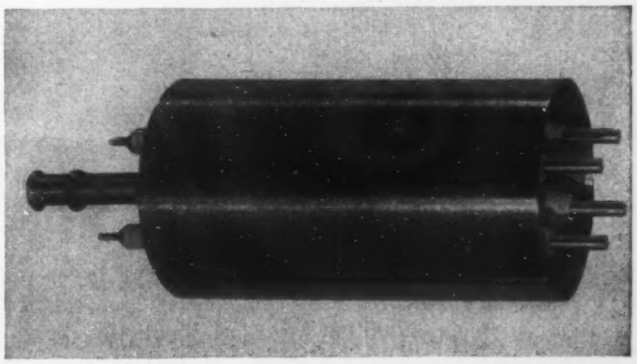
SERIES OF FOUR new carburizing steels with improved carburizing and annealing characteristics also have hardenability comparable to many highly-alloyed steels. Manufactured under the trade name "U.S.S. SuperKore", the metals were developed to fill the need for deep-hardening steels which can be processed and machined easily into heavy-duty parts. Manufacturer: Carnegie-Illinois Steel Corp., 429 4th Ave., Pittsburgh 19.

For further information circle MD 30 on card Page 363

Rectifier Tube

MERCURY-VAPOR type of rectifier tube of new design has no mercury pool, but confines the metal to a new type of cathode in which the condensed vapor returns to cathode without accumulation. Novel construction eliminates mercury splashing owing to possible vibration or shock; reducing arc-drop and increasing tube efficiency. At the same time, use in allowed of multiple anodes, and splash baffles are eliminated. Having no pool, tube may be operated in any position, even functioning upside-down for short periods. It may be used direct-coupled to alternator without use of transformer, thus allowing considerable weight reduction. Tubes in new line of type CL-6000 rectifiers are of stainless-steel construction, welded by a newly-developed method. Ratings include single, double, triple and four-anode types in various dc voltages between 16 and 900 volts, covering current ratings from 15 to 600 amperes. Manufacturer: Clark Electronic Laboratories Inc., Palm Springs, Calif.

For further information circle MD 31 on card Page 363

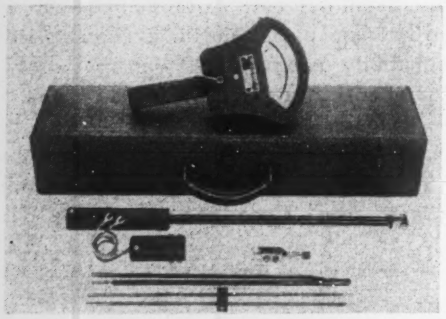


engineering dept equipment

To obtain additional information on these new developments see Page 363

Temperature-Testing Instrument

PORTABLE pyrometer kit is now available from Wheelco Instruments Co., 847 W. Harrison St., Chicago 7. The new Model 2863 kit contains a new high-resistance portable pyrometer equipped with pistol-grip handle, a straight-type extension with adapter for iron-constantan surface thermocouple, and an assortment of thermocouple units. Additional adapter is furnished for use with bare and prong thermocouple tips included in kit. Items are assembled in leatherette carrying case for convenient use.



For further information circle MD 32 on card Page 363

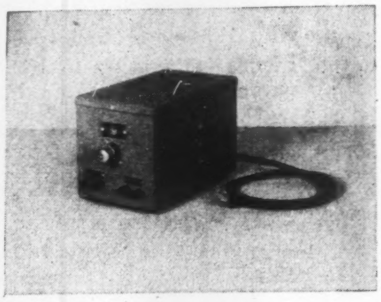
Flow-Measuring Instrument

ULTRA-SENSITIVE air-velocity meter will measure accurately velocities as low as five feet per minute. Meter is applicable to the measurement of velocities in ducts, in air and gas lines and of wind. Principle of operation is based on combination of hot-wire and thermopile principles, this arrangement increases accuracy of the instrument by minimizing errors due to air-temperature variations. Pickup element is a noble-metal thermopile placed in air stream. Alternate junctions are arranged to have much greater cooling than the adjacent junctions which are heated by passing alternating current through wire. Temperature rise of the warmer junctions is measured by the dc thermo-electric voltage generated. Instrument operates from 110 volts ac power and has a range from 0 to 2000 fpm. Fifty feet per minute is approximately 20 per cent of full scale. Manufacturer: Hastings Instrument Co. Inc., Hampton, Va.

For further information circle MD 33 on card Page 363

Self-Balancing Potentiometer

PORTABLE new potentiometer, having many uses in voltage measurement, has been announced by the General Electric Co., Schenectady 5, N. Y. The instrument will measure dc voltages as low as ten microvolts and as high as one volt. It may be used with any indicating or recording instrument drawing up to 5 milliamperes and having a resistance of 1500 ohms or less. The 5 by 7¼ by 10-inch case houses bridge elements, power supply, light source, and light-beam galvonometer. Housed in a welded metal chassis, instrument weighs five pounds and is provided with insulated binding posts for input and output connections.



For further information circle MD 34 on card Page 363

Precision Caliper

NOW BEING MARKETED by Park Sales Co., 417 Canal St., New York 13., is a new, precision inside-outside caliper of Swiss manufacture. This 7-inch No. 17 Roch vernier caliper is made of the finest rustless hardened steel with readings to 0.001-inch. Extremely sharp knife edges increase the accuracy and ease of measurement. The instruments are supplied with metric and English reading scales or with English reading scales alone.

For further information circle MD 35 on card Page 363

MEN... of machines

James E. Gleason

JAMES E. GLEASON, president of The Gleason Works since 1922 and general manager until 1943, has been made chairman of the board for the company. He has been associated with the organization since his apprenticeship in 1884. Mr. Gleason is credited with the development of the two-tool bevel gear generator and later the spiral bevel gear generator, the first machine of its kind and the basis of machines used extensively by automotive concerns in mass production. From 1926 to 1927 he served as president of the National Machine Tool Builders' Association. Various honors and medals have been awarded to Mr. Gleason for notable achievements, among them being the American Society of Mechanical Engineers Medal in 1939 "for service to the cause of safer and better transportation" and recognition from the National Modern Pioneers Committee of the National Association of Manufacturers of his far-reaching inventions of machines to make new types of gears. Mr. Gleason's son—Emmet Blakeney Gleason—succeeds him as president of the company. The new president had been vice president since 1934 and general manager since 1943.

CHARLES L. McCUEN, new vice president in charge of General Motors Research Laboratories, began his automotive career immediately upon graduation from the Polytechnic College of Engineering at Oakland, Calif., in 1911, by joining Cole California Motor Co. as vice president. This firm shortly folded up and Mr. McCuen then became engaged in structural engineering. In 1915 he returned again to the automobile field, becoming associated with the Packard Motor Car Co. as a member of its engineering staff. He remained with Packard until 1919 when he was made vice president of Isko Refrigerator Co. As experimental engineer he joined the Rickenbacker Motor Co. in 1922 and four years later became associated with the engineering staff of Olds Motor Works. While with the Olds organization he designed the F Series 6-cylinder and the L Series 8-cylinder Oldsmobile engines. He then was promoted to chief engineer of Olds and director of engineering, and in 1932 was made technical assistant to the general manager of the Olds and Buick divisions. A year later he was named general manager of the Olds Division. His promotion to vice president in charge of engineering of General Motors came in 1940, which post he has so ably filled prior to his present appointment.

T. A. BOYD, recently elected president of the American Society for Testing Materials, is head of the fuel department of the research laboratory division of General Motors Corp. After receiving his chemical engineering degree in 1918 from Ohio State University, he became research chemist of Dayton Metal Products. When the research division of this organization became a part of General Motors in 1920, forming the basis of its central research division, Mr. Boyd continued in this work. Since 1923 he has been the head of the fuel department. Co-discoverer of the antiknock ef-

Charles L. McCuen

T. A. Boyd

fects of the liquid compounds of lead, Mr. Boyd has devoted his principal efforts to research in automobile and aircraft fuels, and their use to best advantage in engines. Out of this research have come contributions of importance both to automobile gasolines of the present and to the high-output aviation gasoline used in World War II. Mr. Boyd is also an author or co-author of over fifty technical papers and articles, and author of two books. His activities in the society go back many years. From 1931 to 1946 he was chairman of the Committee D-2 on Petroleum Products and Lubricants, and he is still active in that committee.

◆

Eugene S. Clark has resigned as design engineer for the Packard Motor Co., Aircraft Powerplant Division, to join the Menasco Mfg. Co., Burbank, Calif.

◆

William H. Nahm, formerly designer at the Aero Supply Mfg. Co., has been named layout draftsman for the Airtemp Division of Chrysler Corp., Dayton.

◆

Bertil T. Andren, heretofore design engineer at Sherman Products Inc., has recently become senior project engineer in the Lincoln-Mercury Experimental Section of the Ford Motor Co., Dearborn, Mich.

◆

Karl P. Hanson has accepted an appointment as head of the mechanical engineering department at North Carolina State College, Raleigh, N. C., resigning as professor of mechanical engineering at University of Connecticut.

◆

T. A. Boyd recently was elected president of the American Society for Testing Materials. Mr. Boyd is head of the fuel department, research laboratories division, General Motors Corp.

◆

Cearcy D. Miller, a member of the fuels technology division of Battelle Memorial Institute, Columbus, will be awarded the Manley Medal at the SAE Aeronautic Meeting in October. Mr. Miller had been connected with the National Advisory Committee for Aeronautics for the past eleven years.

◆

Ben H. Anibal who has directed the engineering development of the Pontiac car since its inception has retired. He had been with General Motors for 34 years and a chief engineer for 25 years.

◆

John Martin Clark Jr., resigned as powerplant engineer at the Douglas Aircraft Co., to become chief designer and owner of John Clark, Engineers and Designers in San Antonio, Tex., specializing in machine and tool design, product design and styling.

◆

Oliver H. Clark, executive engineer at Chrysler Corp., has retired after 22 years of engineering work with the company. He has held this position since 1935.

◆

Berton A. Purdy, formerly with the International Business Machine Corp., is now magneto design engineer with Gale Products, a division of Outboard Marine & Mfg. Co. Inc., Galesburg, Ill.

◆

Emory N. Kemler has accepted a post at New York University, New York City, relinquishing his previous position as head of the Engineering Research Division, Southern Research Institute, Birmingham, Ala.

◆

Alfred E. Edgerton, secretary of the Engineering Department, of White Motor Co., has been made assistant secretary of the company. He has served as resident patent cousel until 1944 when he was made secretary of engineering.

◆

John H. Holloway, formerly consulting engineer at the Northwest Engineering Co., has been appointed chief engineer, Murphy Diesel Co., Milwaukee.

◆

John R. Herron, until recently connected with the Oliver Corp., has been named assistant chief engineer for Chicago Bumper Co., division of Houdaille-Hershey Corp.

◆

Bruce F. Grimm jr., previously project engineer, has been named chief of design, engine division, G. M. Giannini Co., Inc., Pasadena, Calif.

◆

Gerhard G. Thiem preceding his recent appointment as machine designer of American Machine & Foundry Co., Cheektowaga, N. Y., had been a design engineer, Frederic Flader Inc., Tonawanda, N. Y.

◆

Wilson H. Moriarty recently was elected president of the Malleable Founders Society for the coming year. He is vice president of the National Malleable & Steel Castings Co., Cleveland.

◆

Harry T. Woolson received an honorary degree of Doctor of Engineering from the Stevens Institute of Technology, his alma mater. Mr. Woolson is vice president of the marine division of Chrysler Corp. and president of the Chrysler Institute of Engineering, Detroit.

◆

William H. Heermance recently resigned as chief engineer of the Empire Tractor Corp. to start his own engineering and development company known as Aero Acres, Schwenksville, Pa. The new company is now developing an agricultural tractor of radical design.

◆

Nicholas Bashark as staff engineer of the Parker Appliance Co., Cleveland, will assume direction of the broadened company program of aeronautical equipment development. Before joining this organization, Mr. Bashark was head of hydraulic and related engineering for the Air Materiel Command at Wright Field for eleven years.

◆

Dr. Harvey C. Rentschler retired recently after a 30-year career of directing Westinghouse lamp and electronic tube research at Bloomfield, N. J. Dr. Charles M. Slack Jr. will replace Dr. Rentschler.

◆

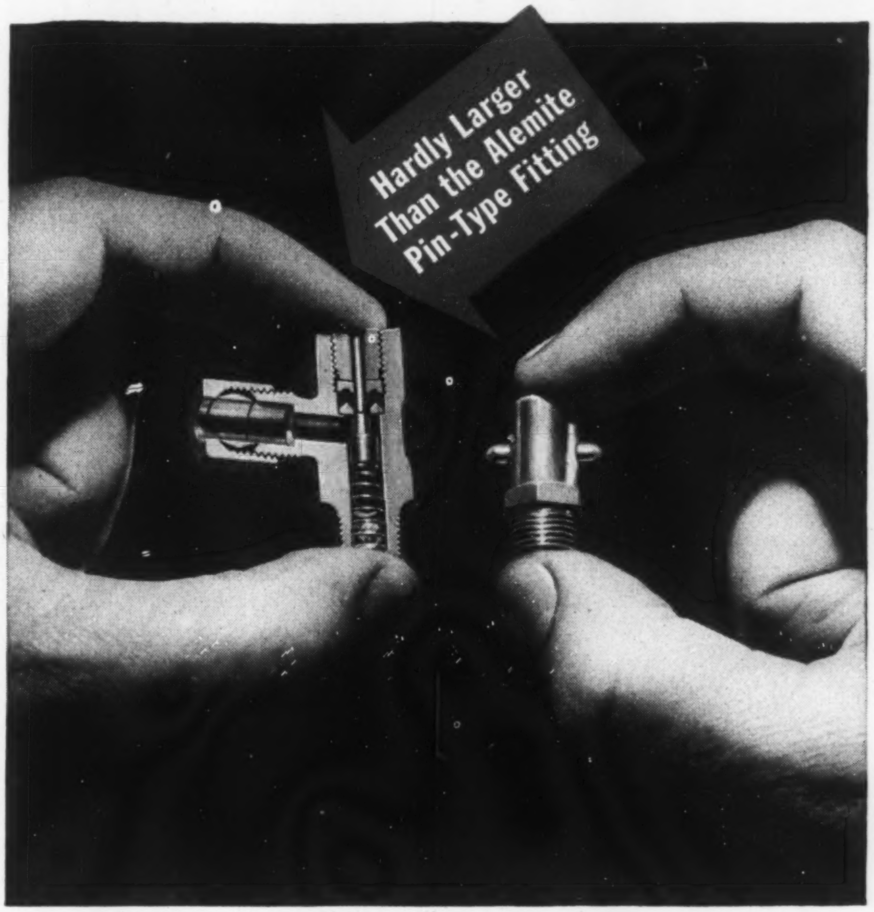
Raymond B. Tripp, executive vice president of Ohio Forge & Machine Corp., Cleveland, has been elected president of the Drop Forging Association. An announcement of Mr. Tripp's appointment as president of the American Gear Manufacturers' Association as well as data on his background appeared in the July issue of Machine Design.

◆

A. B. Gibson recently was awarded the honorary degree of Doctor of Engineering by the Clarkson College of Technology, Postdam, N. Y. Mr. Gibson is founder and president of the Gibson Electric Co., Pittsburgh

Another Alemite "Cost-Cutter"...

NEW ALEMITE "MIDGET" LUBRICANT MEASURING VALVE

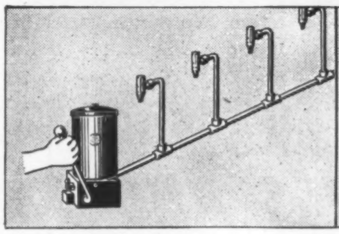


Now You Can Apply Low-Cost Centralized Lubrication to Any Machine

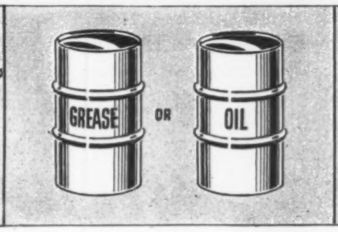
SMALL, SIMPLE, COMPACT . . . this new Alemite "Midget" measuring valve is less than 1½ inches long. In fact, it is not much larger than the popular Alemite fitting used on thousands of machines in every type of industry.

The small sizes of the "Midget," and its simple design, make it suitable for application to all types of heavy, light and precision machines—especially where space limitations are encountered.

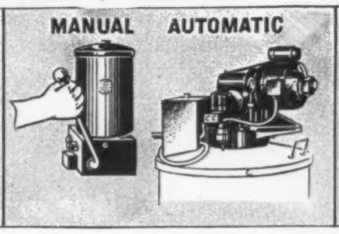
ASK FOR ANY TECHNICAL HELP. Alemite Lubrication Specialists will gladly work with you on any lubrication problems. Their training and experience enable them to render valuable on-the-spot assistance. For an interesting conference and demonstration, write to Alemite, 1804 Diversey Parkway, Chicago 14, Ill.



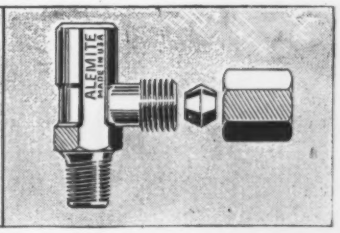
Low Cost, Single Line System. The valves can be mounted on or near bearings, to deliver a measured amount of lubricant from one central point while the machine is producing. No shutdowns, no bearing failures.



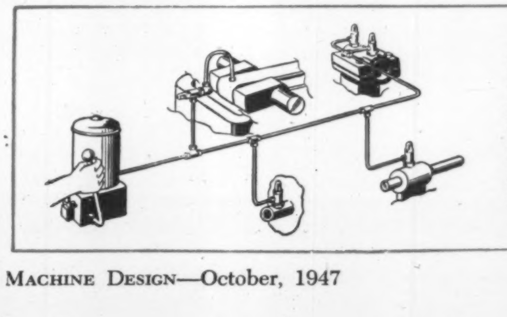
Handles Oil or Grease. There is no danger of over-lubrication or under-lubrication. An indicator signals when the lubrication is completed — eliminating human error. Production goes up . . . costs go down.



Manual or Automatic Operation. A hand pump may be installed in a safe, convenient place on the machine. Or, an Alemite air or electrically operated control will handle a group of machines automatically.



Built-In Compression Fitting is an integral part of the valve and included at no extra cost. No additional fitting is needed to connect tubing to the valve. This is an exclusive Alemite feature.



Serves Any Type of Bearing. Installation accessories are available so that the system can be adapted to rotary, oscillating, stationary — plain or antifriction bearings.

ALEMITE
REG U S PAT OFF

Modern Lubrication that Cuts Production Costs

Another Product of
STEWART WARNER

BUSINESS AND SALES BRIEFS

NEW and expanded quarters of the Cleveland office of Cutler-Hammer Inc. will improve sales and distribution facilities of the company in that area. The new office, with R. J. Eckstein as district sales manager, is located at 2010 E. 46th St., Cleveland 3. Another branch sales office will be located at 107 N. Franklin St., Saginaw, Mich. Managed by R. L. Hibbard, this office will operate as a branch of the Detroit district sales office.

◆

Hydro-Line Mfg. Co., Rockford, Ill., has appointed three new sales representatives: Harry B. Ribbel, located in Arlington, Mass.; John S. Diefenback, with offices at 217 Westfield Ave., Ansonia, Conn.; and R. E. Hayden, located at 200 Lumber Exchange, Minneapolis.

◆

According to a recent announcement, Gustave Treffeisen has been appointed sales manager of the Alemite distribution division of Stewart-Warner Corp. Charles I. Kraus, whom Mr. Treffeisen succeeds, has become Alemite distributor at Minneapolis.

◆

With offices at 1563 Trestle Glen Rd., Oakland 10, Calif., Leslie F. Moody has been appointed sales engineer of the Cambridge Wire Cloth Co., Cambridge, Md. Mr. Moody will cover the state of California.

◆

Brooks & Perkins, Inc. has been formed to succeed the partnership of Brooks & Perkins. Mr. E. Howard Perkins is president of the new firm which will continue to operate as fabricators of magnesium parts and products.

◆

Two new branch offices have been opened by Vascoloy-Ramet Corp., Chicago, Ill. Frank H. Scheffler will head the office located at 7041½ Harrisburg Blvd., Houston, Tex., which embraces the southwest area; and Dean R. Cline will be in charge of the office at 315 Union Arcade Bldg., Davenport, Ia., which covers the Tri-Cities and southern Iowa area. Also announced by the company is the appointment of Tool Engineering Service, 505 North 22nd St., Birmingham, Ala., to serve as manufacturer's agent.

◆

Ralph T. Brengle, of Potter & Brumfield Sales Co., Chicago, has been elected the first president of the recently organized National Association of Relay Manufacturers. The initial goal of the organization is the establishment of a code of standards by which electrical relays may be tested and rated. Also named to the executive panel are C. P. Clare, of C. P. Clare & Co., and J. J. Rowell, of Guardian Electric Mfg. Co. They will serve as vice president and secretary-treasurer, respectively.

◆

Formation of a new electrical products group comprising eleven companies has been announced by National Electrical Manufacturers Association. Dr. H. B. Osborn Jr., sales manager, Tocco Division, The Ohio Crankshaft Co., Cleveland, is chairman of the group which will be known as the Induction and Dielectric Heating Apparatus Section. O. W. Miller, sales manager, Industrial Electronics Division Westinghouse Electric Corp., Baltimore, is vice chairman.

◆

A two-year modernization and expansion program costing $4,000,000 has been planned by SKF Industries Inc. to increase the capacity of its two Philadelphia plants. While the bulk of the expenditures will be for new machinery, the program is aimed primarily at stepping up production of spherical roller bearings.

◆

With headquarters in Milwaukee, D. F. Wenzel has been named manager of sales of the Wisconsin office of Globe Steel Tubes Co. He succeeds T. R. Coffey who recently was transferred to the Detroit office as manager of sales.

◆

Connected with the company for more than six years, Owen G. Watterman has been appointed sales manager of Zagar Tool Inc., Cleveland.

◆

Several appointments have been made by the Owens-Corning Fiberglas Corp., Toledo. These include P. J. Fluge as manager of the yarns division; M. G. Jenson as manager of the storage battery sales section of the equipment and appliance division; and F. L. Myers, formerly with the building materials division, as manager of the corrosion products sales section of the industrial division. In the branch offices, M. W. Butler has been appointed manager of the New York office; W. R. Thomas, manager of the Philadelphia office; and A. E. Kincaid, manager of the Pittsburgh office. A. W. Brown, who formerly was electrical insulation specialist in the Philadelphia office, is serving in the same capacity in the New York office.

◆

Expansion program including new facilities for the Pittsburgh works, to be used largely for production of transformers, has been announced by Allis-Chalmers Mfg. Co., Milwaukee.

◆

Appointment of Claude E. Davis as field engineer in the Midwest has been announced by the Mechanical Goods Division of the Goodyear Tire & Rubber Co.

◆

Louis L. Schneider has been appointed resident representative in upper New York and Western Pennsylvania for the Emerson Electric Mfg. Co. His address is 209 Oakley Drive East, Syracuse, N. Y.

MEETINGS AND EXPOSITIONS

Oct. 18-24—

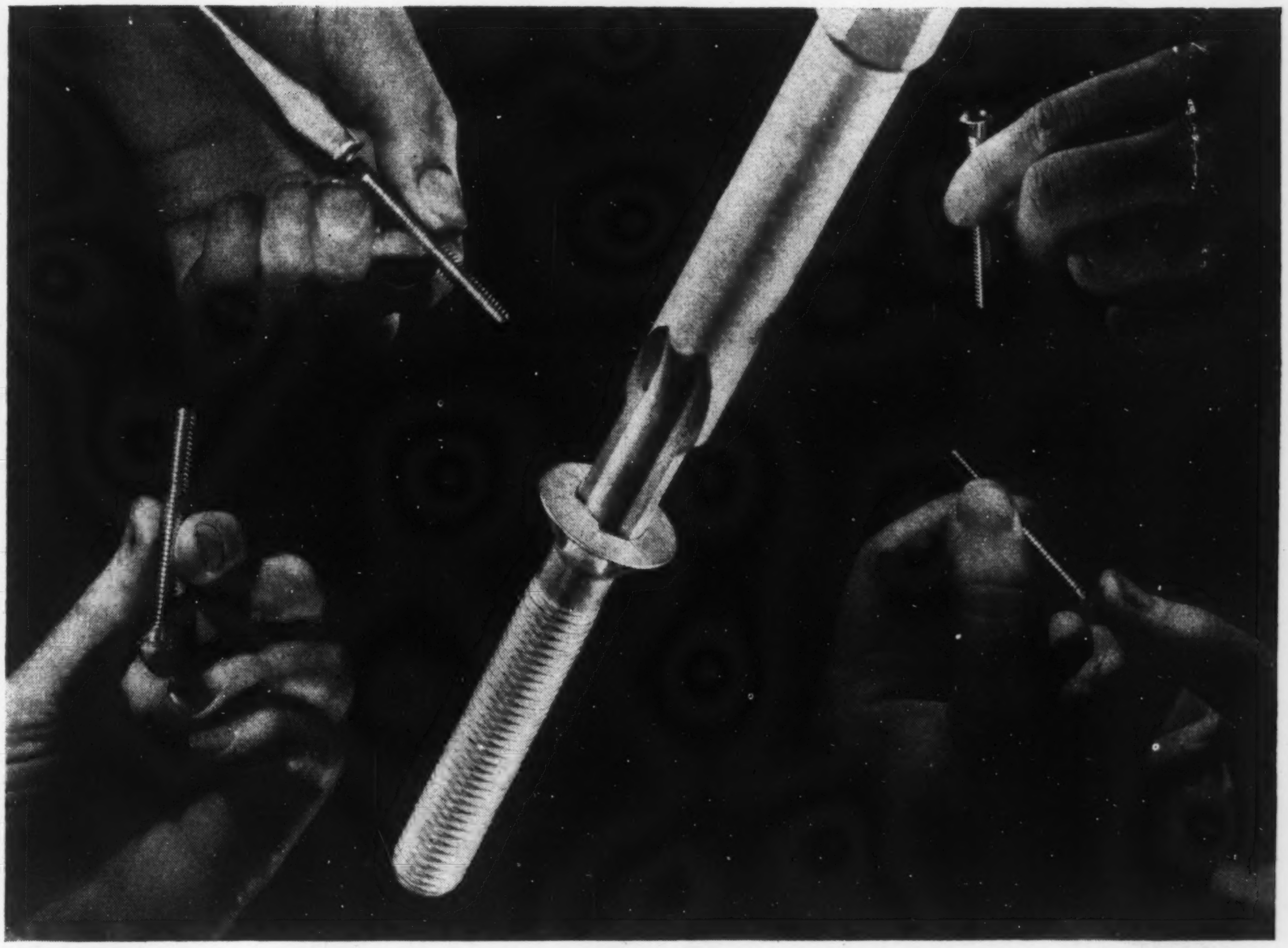
National Metal Exposition to be held at International Amphitheatre, Chicago. Chester L. Wells, 7301 Euclid Ave., Cleveland 3, is assistant managing director of the Exposition.

Oct. 20-21—

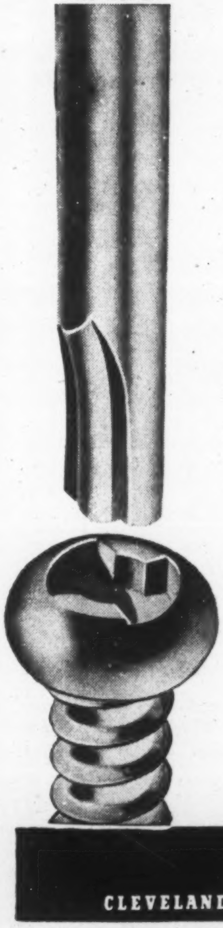
Society of Automotive Engineers Inc. Production meeting to be held at Carter Hotel, Cleveland. John A. C. Warner, 29 West 39th St., New York 18, is secretary and general manager.

Oct. 20-22—

American Society of Mechanical Engineers. Joint meeting of the fuels



TYPE "A" ASSEMBLY BIT



THE CLUTCH HEAD "LOCK-ON"

Ousts Fumbling Fingers

Substitutes Seconds For Minutes

This CLUTCH HEAD Lock-On cancels out the slow-down of haphazard groping . . . on the assembly line and in field service.

A reverse turn by hand of the Type "A" Bit in the Clutch recess unites screw and bit as a unit, forming a definite frictional lock.

Thus, the screw is carried direct to the target for drive home at any angle.

While the Lock-On is positive, normal turning of the screw releases it.

With a Type "A" Hand Driver, service men find it easy to withdraw and save CLUTCH HEAD Screws for re-use . . . *undamaged* and held securely against dropping.

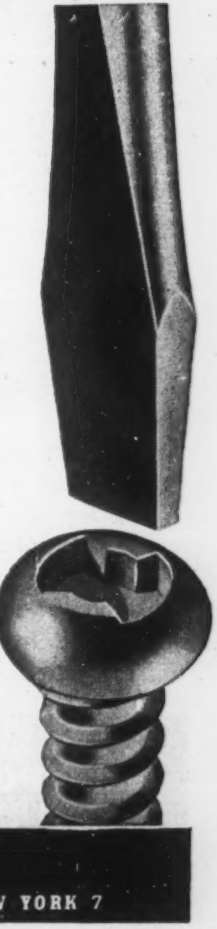
The reverse turning action forms the Lock-On and the screw comes out on the end of the driver.

As opposed to this, consider that a screw dropped in moving parts must be recovered . . . *or else.*

Also that a lost screw may result in an expensive "stall" in operating time.

The Lock-On short-cuts adjustments with a direct reach through the bottlenecks that frequently saves disassembling surrounding units.

COMMON SCREWDRIVER



This Lock-On, available *only* with CLUTCH HEAD, is just one of seven major reasons why you should investigate the safety, speed, and lower cost advantages of America's most modern screw. You may do so by sending for package assortment of screws, sample Type "A" Bit, and Brochure.

CLUTCH HEAD SCREWS

UNITED SCREW AND BOLT CORPORATION

CLEVELAND 2 CHICAGO 8 NEW YORK 7

division with the coal division of the American Institute of Mining and Metallurgcal Engineers to be held at Cincinnati, O. Additional information may be obtained from ASME headquarters at 29 West 39th St., New York 18. C. E. Davies is secretary of ASME.

Oct. 20-23—

American Institute of Mining and Metallurgical Engineers. Annual fall meeting of the iron and steel division and the institute of metals division to be held at Stevens Hotel, Chicago, in conjunction with the National Metal Exposition. Ernest Kirkendall, 29 West 39th St., New York 18, is secretary of the institute.

Oct. 20-24—

American Society for Metals. Annual meeting to be held at Palmer House, Chicago, in conjunction with the National Metal Exposition. W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, is secretary of the society.

Oct. 20-24—

American Welding Society. Annual meeting to be held at Sherman Hotel, Chicago, in conjunction with the National Metal Exposition. M. M. Kelly, 33 West 39th St., New York 18, is secretary of the society.

Oct. 20-24—

American Industrial Radium and X-Ray Society. Annual meeting to be held at Continental Hotel, Chicago, in conjunction with the National Metal Exposition. Philip D. Johnson, 53 West Jackson Blvd., Chicago 4, is secretary of the society.

Oct. 27-29—

American Gear Manufacturers Association. Semiannual meeting to be held at Edgewater Beach Hotel, Chicago 14. Newbold C. Goin, Empire Bldg., Pittsburgh 22, is executive secretary.

Oct. 30-Nov. 1—

American Society of Tool Engineers. Fifteenth semiannual meeting to be held at Statler Hotel, Boston. Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, is executive secretary.

Nov. 3-5—

National Electronics Conference, sponsored by American Institute of Electrical Engineers and Institute of Radio Engineers, to be held at Edgewater Beach Hotel, Chicago. Additional information may be obtained from H. S. Renne, Publicity, Room 2114, 185 North Wabash Ave., Chicago 1.

Nov. 5-7—

American Society of Body Engineers Inc. Annual convention to be held at Rackham Memorial Bldg., Detroit. Otto Graebner, Murray Corp., Detroit, is secretary.

Nov. 6-7—

Society of Automotive Engineers Inc. Fuels and lubricants meeting to be held at Hotel Mayo, Tulsa, Okla. John A. C. Warner, 29 West 39th St., New York 18, is secretary and general manager.

Dec. 1-5—

American Society of Mechanical Engineers. Annual meeting to be held at Chalfonte-Haddon Hall hotels, Atlantic City, N. J. C. E. Davies, 29 West 39th St., New York 18, is secretary.

Dec. 1-6—

Exposition of Chemical Industries to be held in Grand Central Palace, New York. Charles F. Roth, Grand Central Palace, New York 17 is manager of the exposition.

Dec. 4-5—

National Warm Air Heating and Air Conditioning Association. Thirty-fourth annual convention to be held at Hotel Cleveland, Cleveland. George Boeddener, 145 Public Square, Cleveland 14, is managing director.

Dec. 4-6—

Society for Experimental Stress Analysis. Annual meeting to be held at Hotel Pennsylvania, New York. W. M. Murray, P. O. Box 168, Cambridge 39, Mass., is secretary-treasurer.

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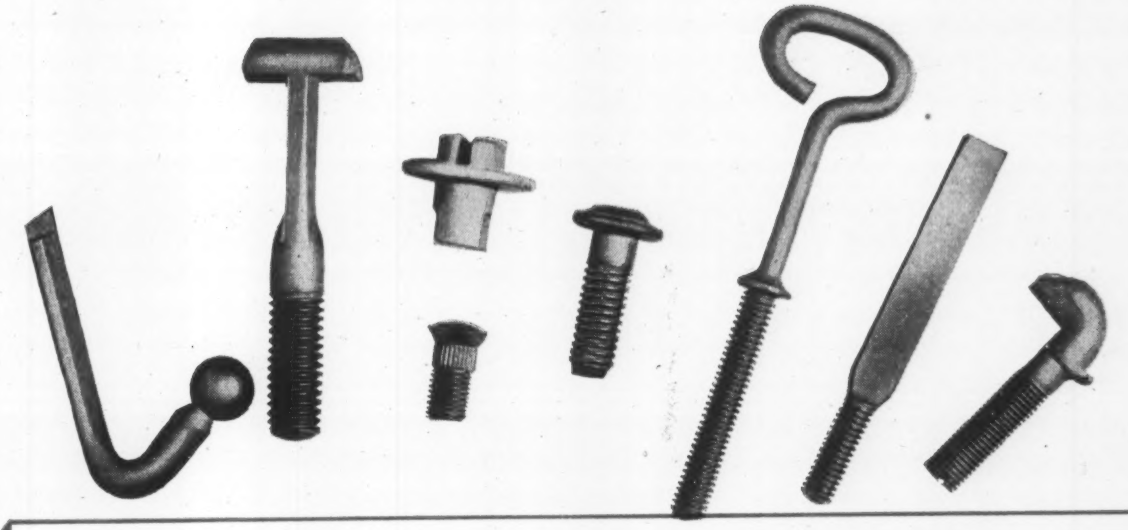
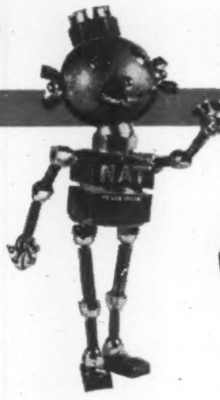
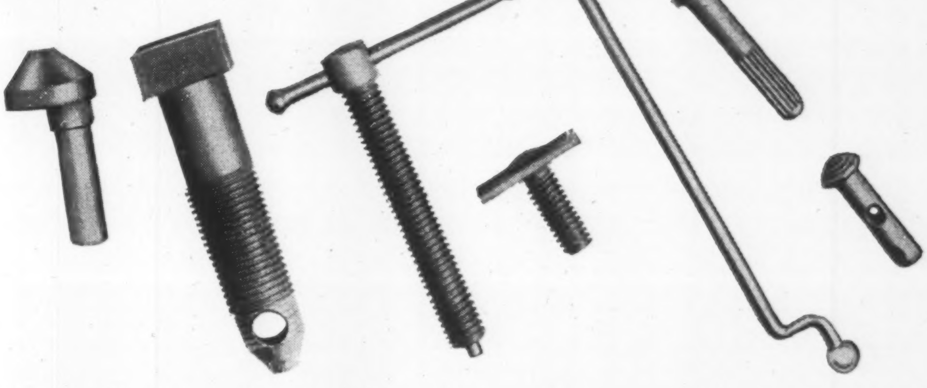


COLD HEADED "SPECIALS"

for Special Fastening Jobs



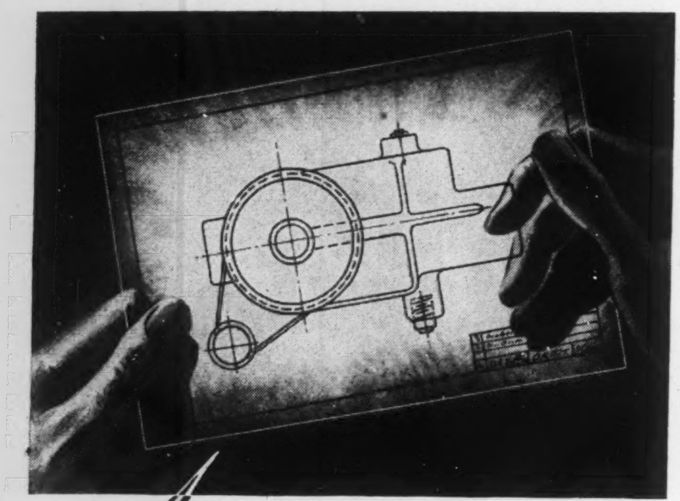


HERE are a few of the many "special" headed and threaded fasteners produced by "National" to solve special fastening problems. Made by the cold headed, upset process, these parts are stronger and more economical than when produced by other methods. "National's" engineers have designed special fasteners for a wide range of industry. The group above represents parts for automotive vehicles, refrigeration, tool manufacturers, metal furniture, lighting fixtures—even prefabricated houses.

If you need a special fastener to fit the products you are making, write us. Our engineering and manufacturing departments may be able to design and make it for you, and save you money.

National
PRODUCTS

THE NATIONAL SCREW & MFG. COMPANY, CLEVELAND 4, OHIO



As if drawn on glass

When you use Arkwright Tracing Cloths, every line, every shading and cross hatching, every dimension reproduces just as sharply as if the tracing were on crystal-clear glass.

A special mechanical process literally "builds" translucence that guarantees perfect reproductions into *every* sheet. There are no surface oils to pile up drawing room time and cause fuzzy prints . . . no chance for distortions or "ghosts", caused by pinholes, specks or thin spots.

And an Arkwright Tracing is a *permanent* tracing. It never becomes brittle . . . it reproduces months and even years later just as crisply sharp as when it first left the board.

Erasures mean little to this time-proven tracing cloth. It can take erasure after erasure without wearing through, resists feathering after erasures.

Why not check these advantages yourself, at our expense. Send for generous working samples to test and see what we mean when we say "lines as clear as if suspended in air." Arkwright Finishing Company, Providence, R. I.

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Arkwright
TRACING CLOTHS
AMERICA'S STANDARD FOR OVER 25 YEARS

Overload Devices

(Concluded from Page 100)

commercial machines along these lines. For instance, should the cutter stall on a milling machine, it is invariably broken by the inexorable advance of the feed. A shear-pin is provided by some manufacturers but it is not adjustable and so cannot save a cutter which does not call on the full capacity of the machine. On any large drilling machine, it is not an uncommon experience for the drill to be broken or the work to be torn loose from its clamps at the moment of break-through. Detent or friction clutches would solve these problems and have in fact been used to advantage by automobile manufacturers and others. They may be a nuisance to adjust for each job, but have been found to pay on large production runs.

Another possibility is seen in business machines, which are sometimes prone to jam. The tiny motor often gets the worst of it, but a spring-belt drive might give protection at nominal cost. Conveyors are notorious offenders, but protection to date has been largely shear-pin, which is often inadequate.

Chemical processing machines, such as agitators, mixers, and centrifugals, seem to offer progressive builders an excellent opportunity to improve their product. Also included are packaging equipment, bottle washers, automatic sand blasters, paintsprays, and all the other machines where a product is expected to remain upright as it moves through the machine, but will snarl up the works if it tips over. In designing any machine more complicated than a bench drill, the engineer should be as ready to provide overload protection as he now is to specify flexible couplings.

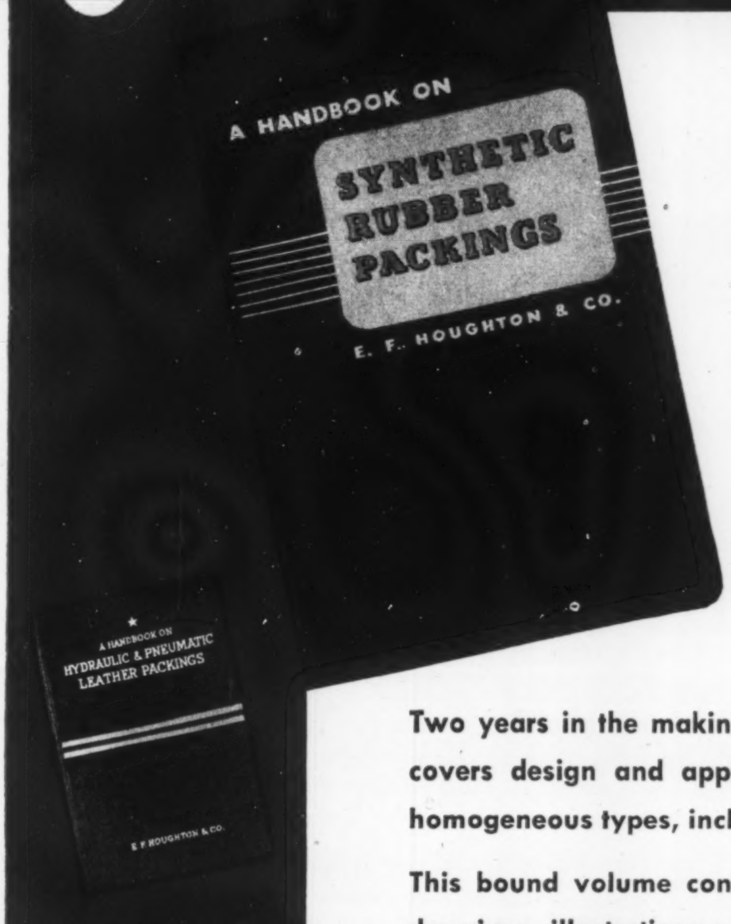
Factors of Selection

This article and the preceding article have touched on a wide variety of protective devices and drives, many of which are commercially available. Once the decision is made to use such a device, the apparently difficult task of selection can be considerably simplified if the engineer bears in mind the fact that most are multiple-purpose. Thus he can select that combination of characteristics—be it cushioned action, easy starting, variable speed, high accuracy, over-speed or under-speed release, etc.—which is best suited to his needs and budget.

The prime criteria applicable to any proposed protective device will be cost, maintenance, reliability, sensitivity, adjustability, compactness, shock resistance, and need for reset. For the average drive, such as that for a conveyor or bottling machine, the writer recommends a friction clutch of some type, giving thought, of course, to proper provision for wet or dry running conditions. Protection of a cam shaft or other timed subdrives calls for a shear-pin, a spring detent, or spring-loaded levers. This problem of selection is made less formidable when the engineer realizes that, like many other selection problems, there are undoubtedly several adequate solutions to each drive.

The writer would like to acknowledge the helpful suggestions offered by Mr. J. R. Boyer, power transmission consultant of the Du Pont Company, in the preparation of this article.

Another "first"!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Silicone News

DC
SILICONES

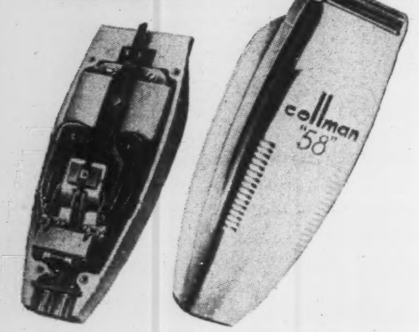

PHOTO COURTESY COLLMAN MANUFACTURING CORP.

DC 44 Silicone Grease is used to lubricate this new electric shaver made by the Collman Manufacturing Corp.

FOR A LONG LIFE OF TROUBLE-FREE SERVICE

In electric shavers or locomotives, the basic requirements are the same—long life and trouble-free service. These requirements are met by designing and redesigning to capitalize on the properties of the best materials available.

The kind of lubricant used is frequently as important as the materials of construction or the tolerances and workmanship. An unusual example is the experience of Collman Manufacturing Corporation of Erie, Pa., makers of the Collman "58" electric shaver.

In this shaver a small four pole motor on a case hardened steel shaft rotates at high speed in plastic laminated bearings. Many organic greases were tried, but none of them had enough lubricity to increase the original speed of the motor. But use of DC 44 added 1500 r.p.m.—proof of its excellent lubricity between hardened steel and plastic bearings.

And DC 44 stays where it's put. Bleeding of DC 44 is less than 2% after 16 hours at 110°C. That means more permanent lubrication. It also means more trouble-free operation in this application where the electrical contact points are only half an inch from the bearings. Organic greases migrated, decomposed on the contact points, and stopped the motor. DC 44 has less tendency to migrate and it does not decompose to form troublesome gums or sludges.

In the trend toward really permanent lubrication the DC Silicone Greases are inescapable. You'll find them described in data sheet No. B 7-5.

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Diffusion Pump
Mold Release

GREASES
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NEW MACHINES

And the Companies Behind Them

Air Conditioning

Air conditioner featuring new control for eliminating short cycling of compressor. Available in sizes up to 40 tons. United States Air Conditioning Corp., Minneapolis 14.

Home ventilating fan. Moves 350 cu ft of air per minute, changing air of room 9 x 12 x 7 ft every 2 min. Westinghouse Electric Corp., Pittsburgh 30.

Air conditioner of saturating spray type. Delivers 2000 cu ft of air per minute, and occupies 7½ sq ft. Other models are available. Niagara Blower Co., New York 17.

Business

Direct process, liquid type duplicator. Requires one turn of handle for each copy, printing over 100 copies per min. Registration plus or minus 1/64-in. Ditto Inc., Chicago 12.

Deluxe intercommunication systems, consisting of one master and one substation. May be made up progressively, adding substations as needed. Operates on 110-115 volts, ac or dc. Talk-A-Phone Co., Chicago 23.

Cleaning

Triple-stage washing machine for processing of light, small, cup-shaped stampings of comparatively uniform depth. Mabor Co., Rahway, N. J.

Blow gun with regulating trigger for fully controllable air flow. Superior Mfg. Co., Cleveland.

Commercial

Large-screen television receivers providing pictures of newspaper size and 50 ft lamberts in brightness. Includes standard broadcast, FM, and shortwave radio. Radio Corp. of America, RCA Victor Div., Camden, N. J.

Construction

Mechanized wheelbarrow capable of carrying 1-ton loads at speeds 7 to 15 miles per hour. Virtually a miniature dump truck. Novo Engine Co., Lansing, Mich.

Excavator, ¾-cu yd, with variation front and combinations, making it a shovel, dragline, clamshell, crane and backhoe. Marion Power Shovel Co., Marion, O.

Portable gravel plant. Total weight, less power unit, approximately 40,900 lb. Pioneer Engineering Works, Minneapolis.

Domestic

Power lawn mower, all-steel, built for use with garden tractor. Size: 24 inches. Lodge & Shipley Co., Cincinnati.

Cylinder-type vacuum cleaner. Dirt ejector empties bag. Has two handles—one for carrying or storing in a horizontal position, and another for carrying or storing vertically. The Hoover Co., North Canton, O.

Automatic electric irons with extra insulation and protection for hand from heat. Weights 4½ lb and 3¼ lb. Operate on 1000 watts, 110-120 volts ac. The Hoover Co., North Canton, O.

Excavating

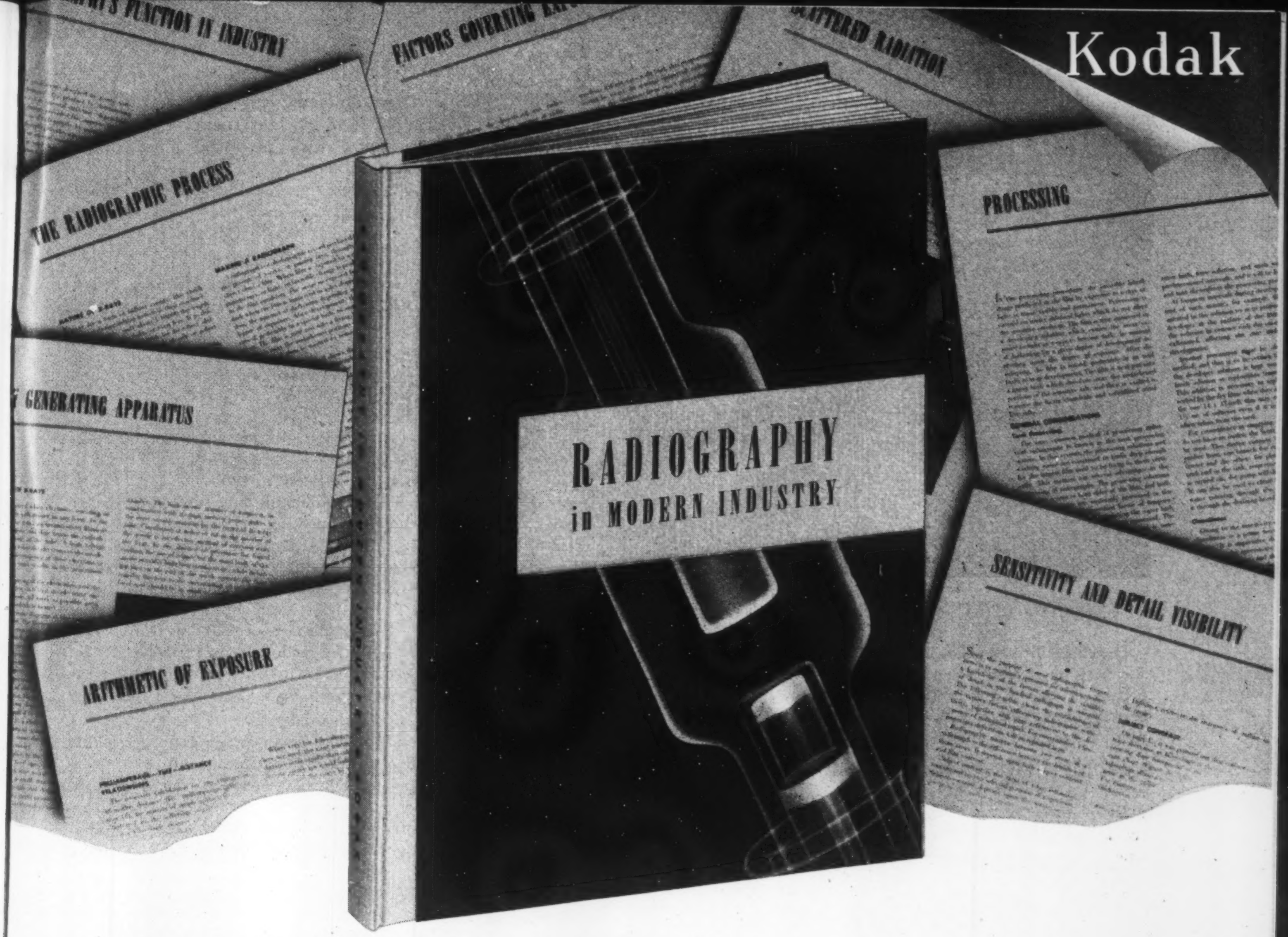
Small, self-loading earthmoving machine. Has fingertip control, also motor operating a steering gear on yoke king pin. R. G. LeTourneau Inc., Peoria, Ill.

Motorized scoop—a tricycle-type materials handling machine. Control of buckets accomplished by two hand levers. Mixermobile Manufacturers, Portland, Ore.

Four rear-wheel, dump truck. Has chain drive. For heavy-duty service will carry 22½ cu yd with a 125,000 lb gross weight capacity. Knuckey Truck Co., San Francisco.

Finishing

Sander and polisher for wood, metal or plastics. Has 115-volt motor, usable on a-c or d-c. Diamond-Detroit Inc., Detroit.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HOW TO TIGHTEN A SOCKET SCREW'S GRIP

. . . without safety wires

Specify BRISTO "Multiple-Spline"

Defying vibration that often shakes "hex" screws loose . . . speeding assembly of products with hard-to-reach fastening points . . . easing disassembly — BRISTO "Multiple-Spline" Socket Screws are now making a hit with many designers and production men.

BRISTO "Multiple-Spline" gets its tighter grip from the unique way the wrench, geared to the spline-shaped socket, pulls the screw around. No expanding pressure. No bursting or rounding out of socket walls. Yet, a flick of the wrench releases the deep-seated grip.

Literature describing BRISTO "Multiple-Spline" Socket Screws and their many applications is yours for the asking.

THE BRISTOL COMPANY, Mill Supply Division, 122 Bristol Rd., Waterbury 91, Conn.

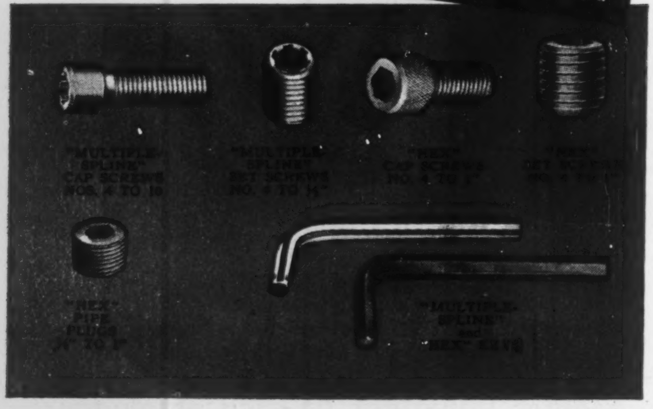
WHY "MULTIPLE-SPLINE" MEANS **TIGHTER**

NO EXPANDING PRESSURE: THE KEY PULLS THE SCREW AROUND

MULTIPLE SPLINE SOCKET BRISTO SET & CAP SCREWS

Only the "B-LINE" has the right socket screw for every application

The BRISTOL Company MILL SUPPLY DIVISION


"MULTIPLE-SPLINE" CAP SCREWS NOS. 4 TO 16
"MULTIPLE-SPLINE" SET SCREWS NO. 4 TO ½"
"HEX" CAP SCREWS NO. 4 TO 1"
"HEX" SET SCREWS NO. 4 TO 1"
"HEX" PIPE PLUGS ¼" TO 1"
"MULTIPLE-SPLINE" and "HEX" KEYS

Portable disk sanders and polishers. New design for cooling motor and tool grip. Bradford Machine Tool Co., Cincinnati.

Belt grinders for machining contours by flexed abrasive belt. Porter-Cable Machine Co., Syracuse, N. Y.

Power sander designed for fast, comfortable operation. Available in a heavy-duty 7-inch type and in a 9-inch standard duty model. Aristo Power Tools Inc., Chicago 6.

Foundry

Fork trucks designed for pouring metal from foundry ladles equipped with built-in pallets. Elwell Parker Electric Co., Cleveland 14.

Heat Treating

Small oven furnace for low pressure air use—10 to 16 oz. Temperature range is 1400-1600 F. Eclipse Fuel Engineering Co., Rockford, Ill.

Two prepared-atmosphere furnaces: Atmosphere and gas carburizing. Have balanced carbon principle of heat treating. Surface Combustion Corp., Toledo 1.

Induction melting furnace for aluminum, brass and zinc. Fisher Furnace Div., Lindberg Engineering Co., Chicago.

Electric furnace with 300-2000 F temperature range. Incorporates selective power modifier and vertical lift door. Automatic control panel available. Cooley Electric Mfg. Corp. Indianapolis.

Roller hearth electric brazing furnace of 320 kw. Automatically controlled door is 35 in. wide, opens vertically 13 in. Heating chamber, extending 17 ft, brazes at 2050 F. General Electric Co., Schenectady 5, N. Y.

Industrial

All-purpose floor machine. Has motor-driven interchangeable brushes. Breuer Electric Mfg. Co., Chicago 40.

High-low pressure power pack for actuating large presses. Greer Hydraulics Inc., Brooklyn 15.

Heated air generator for air of controllable velocity, temperature, quantity and pressure. Todd Shipyards Corp., Queens, L. I., N. Y.

Portable electric cleaner, powered by a 1 1/3-hp motor, blowing air at 25,500 fpm. Total weight, 14½ lb. Ideal Industries Inc., Sycamore, Ill.

Cone-type diluters for automatic gas-air premix systems. Eclipse Fuel Engineering Co., Rockford, Ill.

Collator for taking paper, foil, plastics, tissue or other webs from rolls, for collating, perforating, strip-gluing, inserting tissue-sheets, etc. Vertex Co., New York 12.

Magnetic separator of cross-belt type for concentration of feebly magnetic ores, removal of contaminating magnetic specks and iron oxides from chemicals, powders, etc. Magnetic Engineering & Mfg. Co., Clifton, N. J.

Nameplate stamping machine stamps up to ½-in. characters into aluminum and up to ¼-in. characters into steel. The Acromark Co., Elizabeth 4, N. J.

Air-powered, heavy-duty nut setter; adjustable torque; overall length, 8½ in.; weight, 6 lb; speed adjustable from 500 to 1000 rpm. The Aro Equipment Corp., Bryan, O.

Automatic engraving and profiling machine. Besides engraving in 1:1 ratio the machine, being supplied with a pantograph, allows engraving in desired reduction. Airdraulics Inc., New York 25.

Inspection

Mechanical electronic shop instrument for recording shape, height and spacing of surface irregularities. Physicists Research Co., Ann Arbor, Mich.

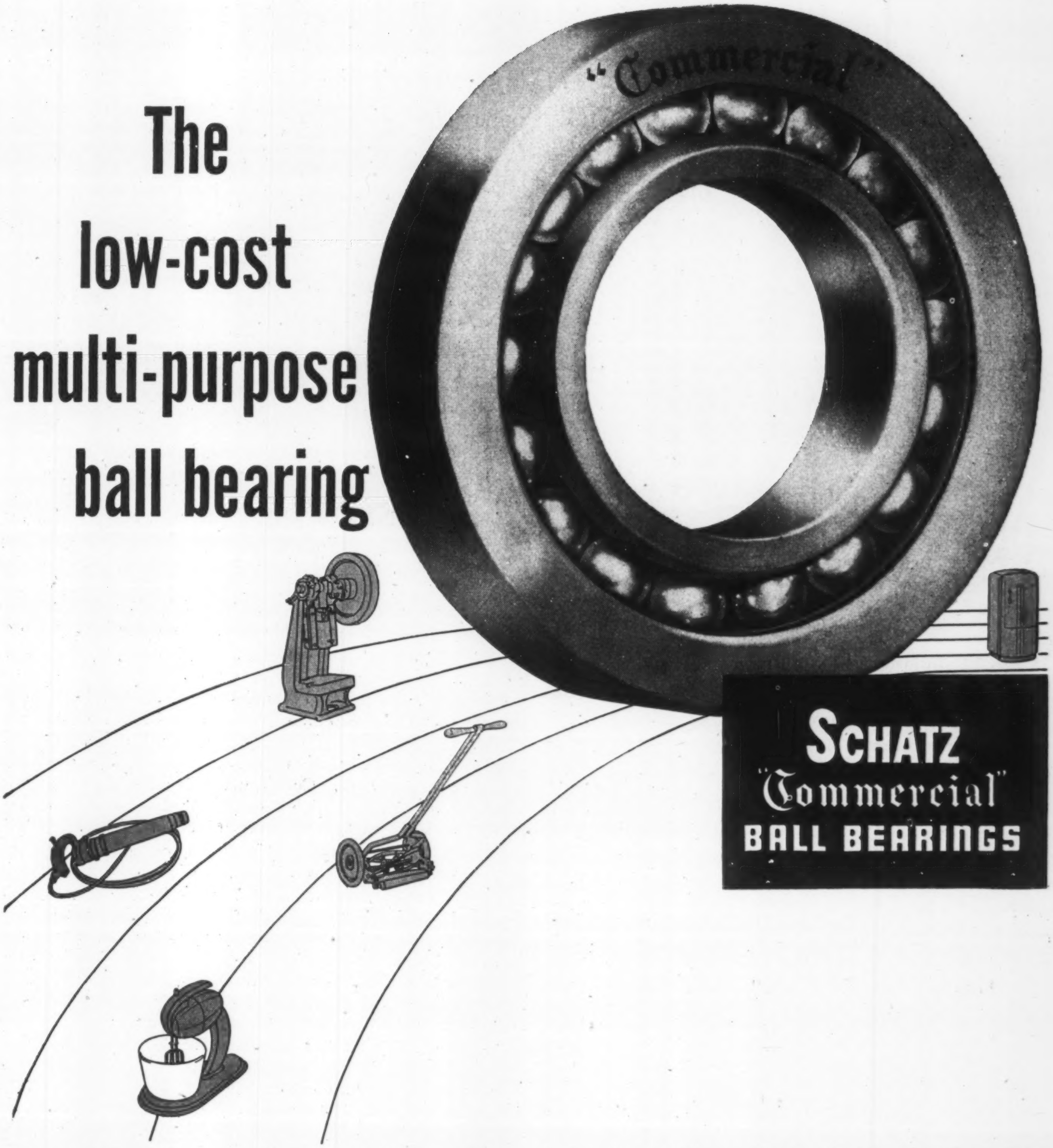
Automatic bottle gaging machine. For neck openings. Gages at 225 bottles per minute. Russell & Thompson Mfg. Co., Newark 7, N. J.

X-ray back-reflection unit for field inspection, particularly stress analysis. St. John X-ray Laboratories, Califon, N. J.

Instruments

High precision source-unit for spectrochemical analysis. Ap-

The low-cost multi-purpose ball bearing



SCHATZ
"Commercial"
BALL BEARINGS

You write "rugged" into your blueprints—at low-cost—when you make Schatz "Commercial" Ball Bearings part of your design. For, unlike other moderate-priced bearings, "Commercials" combine *through-hardened* chrome alloy balls with high-grade, low-carbon, cold-rolled steel rings.

Long bearing life is equal to the sum of these parts...and extra-utility, too. So it's not unusual to find "Commercials" rolling along in all kinds of service, delivering efficient, friction-free operation in stamping presses and lawn mowers, or in riveting machines and refrigerators.

Compare their on-the-job performance with other low-cost ball bearings. And consider, too, the plus value of Schatz engineering counsel while your application is in the design stage. A fifty year fund of ball bearing "know-how" is at your disposal.

Schatz "Commercials" are manufactured in all standard types and sizes to cover the wide range of ball-bearing applications where moderate cost is a vital factor alongside of maximum efficiency. The answer to your anti-friction problem is among them.

Remember, Schatz makes only ball bearings, and "Commercials" are manufactured only by Schatz.

THE SCHATZ MANUFACTURING COMPANY
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"CHICAGO SCREW"

To get the number of fastenings you need . . . order by quantity. But more important, to get the accuracy and holding power you need... order by quality.

All Chicago Screw fastenings are of the highest quality, manufactured from the finest materials and unsurpassed for strength, accuracy and clean, true threads.

The knowledge, facilities and experience acquired during 75 years of manufacturing fine threaded products has resulted in a line of fastenings ideally suited to all modern production methods.

Chicago "SAFETY PLUS" line includes:

Socket Head Cap Screws • Socket Set Screws • Stripper Bolts • Square Head Dog Point Set Screws • Socket Pipe Plugs • Keys for "Safety Plus" Products.

Complete line includes:

Hexagon Head Cap Screws • Square Head Cup Point Set Screws • Headless Set Screws • Fillister Head Cap Screws • Flat Head Cap Screws • Taper Pins • Milled Studs • Semi-Finished Hexagon Nuts • Semi-Finished Hexagon Castellated Nuts.

These Fine Products are sold only thru Authorized Distributors

1872 1947

THE CHICAGO SCREW CO.
ESTABLISHED 1872
1026 SO. HOMAN AVENUE CHICAGO 24, ILL.

plied Research Laboratories, Detroit 10.

Microprojector for determining of numerical concentrations of impinger and precipitator dust samples. Mine Safety Appliances Co., Pittsburgh.

Materials Handling

Fork truck with interchangeable slewing boom attachment. Capacity up to 1820 lb; height, 18 ft 5 in., and horizontal arc, 120 deg. Automatic Transportation Co., Chicago 20.

Fork truck with higher tiering and lower uprights for loading cars. Maximum lift, 120 in.; overall height, 83 in. with forks lowered. Clark Tructractor, Battle Creek, Mich.

One-ton fork truck for interplant use. Pneumatic-tired, gas-powered, 2000 lb capacity. Clark Tructractor, Battle Creek, Mich.

Portable crane for locomotive trimming in engine house, car repair track work, etc. Capacity, 3000 lb. Baker Industrial Truck Div., Baker Raulang Co., Cleveland 13.

High-low stack lift for fork truck. Height, 30 in., and overall collapsed height, 83 in. Clark Tructractor, Battle Creek, Mich.

Fork truck capable of tiering to truck and trailer ceilings as low as 68 in. and having a total lift of 100 in. Automatic Transportation Co., Chicago.

6000-lb capacity power jacklift, completely electric, and of platform type. Lewis-Shepard Products Inc., Watertown 72, Mass.

Metalworking

Convertible die-casting machine, hydraulically operated. Heavy-duty type, it is convertible from normal cold chamber to optional hot chamber operation. H. L. Harville Mfg. Co., Corona, Calif.

Machine for grinding and chamfering teeth on spring clutches. The Cross Co., Detroit.

Midget multipress for pressing requirements between 200 and 2000 lb. Offers same features as large multipress. The Denison Engineering Co., Columbus 16, O.

Cylindrical grinding and indexing attachment for use on surface grinders adapting them for dry grinding of small cylindrical work and work requiring indexing. The Brown & Sharpe Mfg. Co., Providence 1, R. I.

Multiple-spindle automatic screw machines. 1¼-in. and 2¼-in. sizes are available, with features such as automatic electric stops, spindle carrier lifting mechanism, automatic locating and locking of carrier, etc. New Britain-Gridley Machine Div., The New Britain Machine Co., New Britain, Conn.

Woodworking and Lumber

Portable saw rig for woodworking jobs on a farm. May be powered by tractor or jeep takeoff, gasoline engine, or electric motor. Pritchardsons', Chicago 32.

Compressed air wood dowel gluer. Utilizes about 100 lb air pressure. North End Millwork Co., Seattle.

Jointer with steel cutterhead cuts up to 6 in. wide and 5/16-in. deep, and operates at 6000 rpm. Teston & Anderson, Fairfield, Ia.

Electric ball bearing moulder. Feed drive is of variable V-belt type. Speed range is from 40 to 360 fpm without changing sprockets, gears or pulleys. Premier Gear & Machine Works, Portland 5, Oreg.

Brush cutting truck. Has 7-ft cutting bar, powered independently which can be raised or lowered for various roadside conditions. Moves at speeds up to 3 or 4 miles per hour and clips brush as thick as 2½ in. in diam. Weyerhaeuser Timber Co., Cowlitz County, Wash.

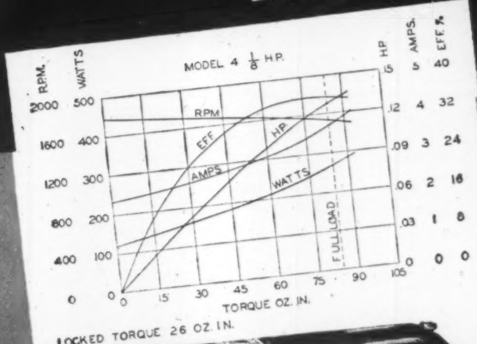
Single-spindle shaper. Takes knives up to 3½ in. wide and permits spindle speeds up to 7200 rpm. Accommodates motors of ½, ¾ and 1 hp. Royal Wade Products Co., Dallas.

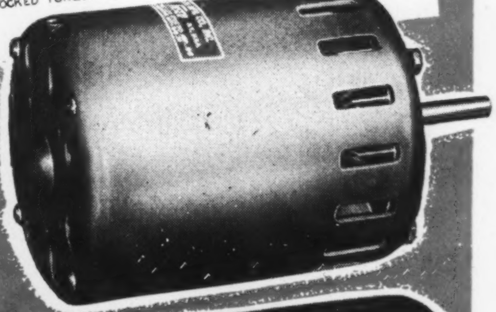
Planer and matcher. Feeds 40 ft up to 150 fpm. Size: 14 x 24 x 6 in., of single or double profile type. Newman Machine Co. Inc., Greensboro, N. C.

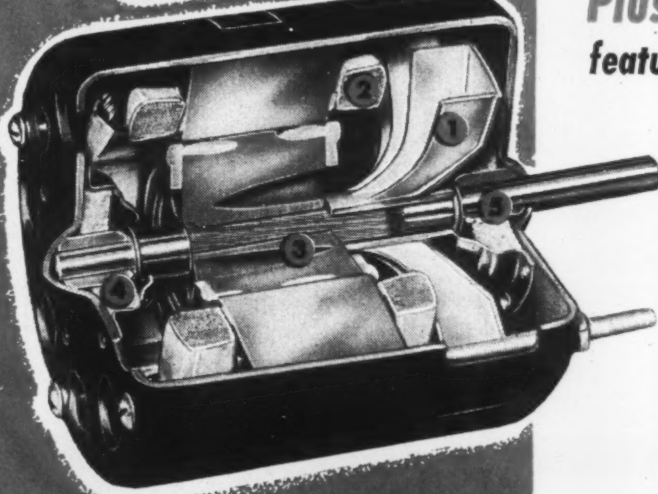
Wichita City Libr

NEW! FASCO SERIES R

SHADED POLE FRACTIONAL H.P. MOTOR DELIVERS 1/8 HORSEPOWER!







Now you can have the proved economy of a shaded pole motor in a new high power range

Here is a *new, exclusive* package of potential product design and sales advantages for you . . . all wrapped up in the new Fasco F.H.P. Motor Series R. Fasco *experienced* engineering and production know-how brings you in this Fasco shaded pole F.H.P. motor new high power, available before only in a capacitor or split-phase type motor at higher cost. Ideal for applications where starting torque is low and running torque requires up to 1/8 H.P. Designed for continuous operation under long hour duty load. Quiet, economical, trouble-free operation, dependable speed control and other Fasco F.H.P. motor advantages are incorporated.

Plus FASCO-built quality features for better performance

1. INTEGRAL COOLING FAN, of new design and large vent holes.
2. TAPELESS COILS, for improved heat dissipation.
3. UNIFORM ROTOR RESISTANCE and BALANCE from new pressure assembly and automatic machine welding.
4. LUBRICATED from large felt-filled reservoirs and a new oxidation-resistant oil.
5. BEARINGS are precision oil-less, self-aligning type.

WRITE *on your company letterhead for complete information including dimensions, specifications and performance data. No obligation.*

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F. A. SMITH MANUFACTURING CO., INC.
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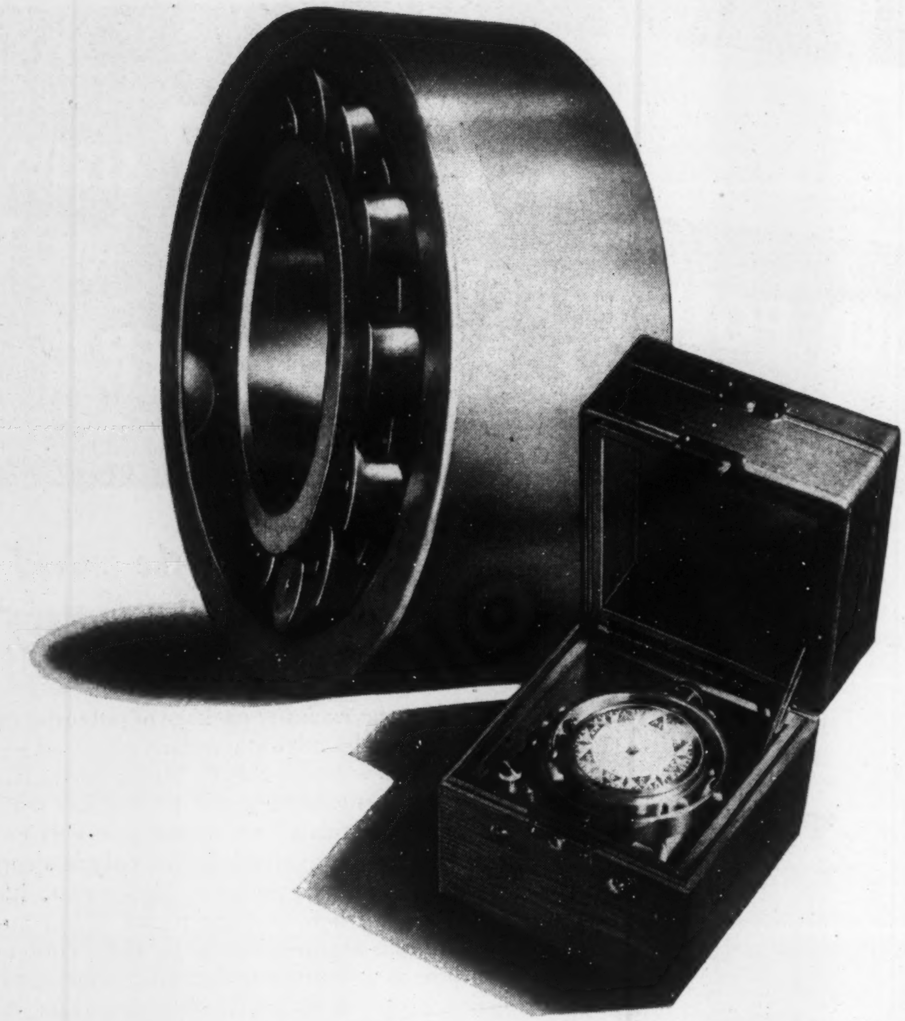
FORMERLY Pilot MOTORS



Automatically self-adjusting . . .

because of the use of spherical rollers turning in an outer race which is a section of a true sphere, the Spherical Roller Bearing adapts itself freely and easily

To misalignment or deflection.

This feature assures dependable operation of the bearing since the total area of bearing contact surface is maintained under all conditions. It eliminates undue wear and premature bearing failure which ordinarily result from uneven stresses set up by misalignment.

The high radial capacity, two-directional thrust capacity, unit construction and self-aligning features of the Spherical Roller Bearing may solve *your* friction problem. For further information, write for Bulletin No. 200-A.

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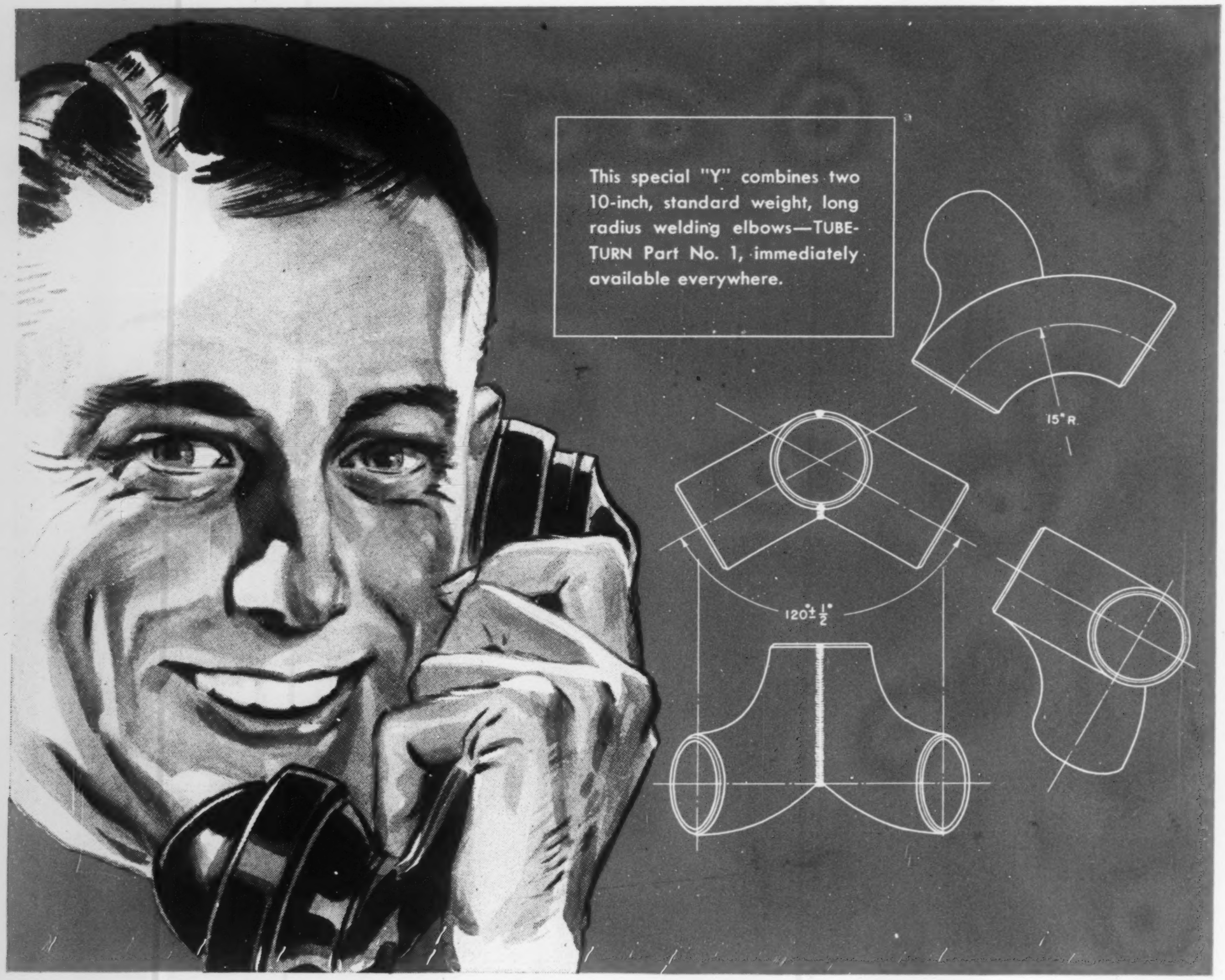
FOURTEENTH EDITION

SUPPLEMENT TO MACHINE DESIGN OCTOBER, 1947

Materials Listed by Trade Names
Index of Materials by Type
Producers of Materials



This special "Y" combines two 10-inch, standard weight, long radius welding elbows—TUBE-TURN Part No. 1, immediately available everywhere.

"A speedy, simple, satisfactory answer"

MANY'S the time when a long delay in getting a special fitting seems unavoidable. Many's the time when that fitting can be fabricated from TUBE-TURN Welding Fittings out of stock and give you the right answer—"speedy, simple, satisfactory."

The "Y" diagrammed above was put together with standard TUBE-TURN welding fittings, shown in Tube-Turn Catalog No. 111, and taken out of regular stock. This gave the designer what he needed when it was needed, in a hurry.

TUBE-TURN welding fittings are particularly suitable for piping fabrication because of the uniform wall thickness and full circularity which allows them to be cut and joined at odd angles and because of uniformity from fitting to fitting. Order two, a hundred, or a thousand TUBE-TURN welding fittings of the same size and part number, and they will be dimensionally alike.

TUBE-TURN welding fittings and flanges are manufactured in more than 4000 types and sizes. They come in a wide variety of metals and alloys. For details, contact the nearest TUBE-TURN distributor. For his name, write to—

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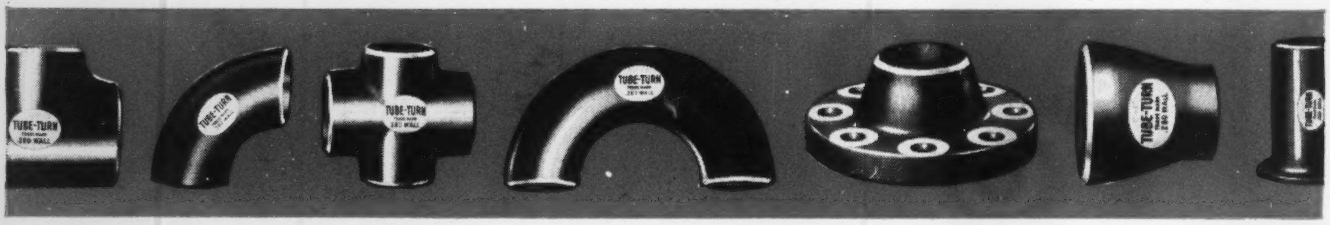
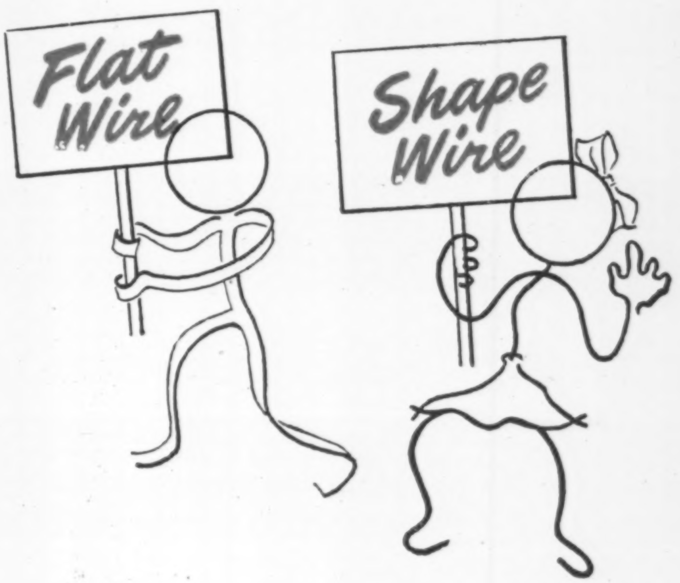
District Offices at New York, Washington, D. C., Philadelphia, Pittsburgh, Detroit, Chicago, Houston, San Francisco, Los Angeles

TUBE-TURN tt *Welding Fittings and Flanges*
TRADE MARK



IF YOU MAKE IT OF WIRE MAKE IT OF THE BEST

We have 400 different types to choose from



PRODUCED in more than 400 different types, comprising almost every conceivable size, grade, shape and analysis, U·S·S American Quality Wire has been used in more than 160,000 different manufacturing applications . . . one of which is probably similar to *your* application.

American Quality Wire is backed by over 100 years of quality wire making experience. Its manufacture is precisely controlled from ore to finished product. Because it is always uniform in analysis, strength and gauge it meets specifications exactly . . . permits trouble-free production.

Our engineers will gladly go over your wire problems with you, to help you determine which American Quality Wire is best suited to your needs.

AMERICAN STEEL & WIRE COMPANY
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Tennessee Coal, Iron & Railroad Company, Birmingham, Southern Distributors
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UNITED STATES STEEL

If you make it of wire . . . make it of the best

U·S·S AMERICAN

QUALITY WIRE

USS AMERICAN MANUFACTURERS WIRE UNITED STATES STEEL

PROGRESSIVE SHOWED THEM HOW TO

... *double production*

... *cut cost in half*

by cutting 33 operations to 5

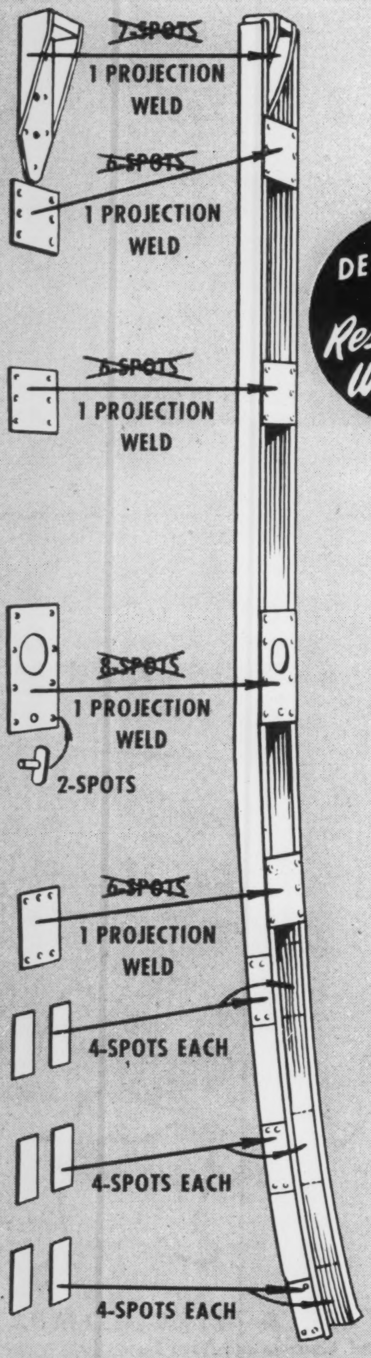
DESIGNED for *Resistance Welding*

Hawthorne Metal Products Co. of Detroit had a contract to produce reinforced stamped pillars for bus bodies. Their cost was low since they were using spot welding to assemble the 13 separate stampings at 50 an hour.

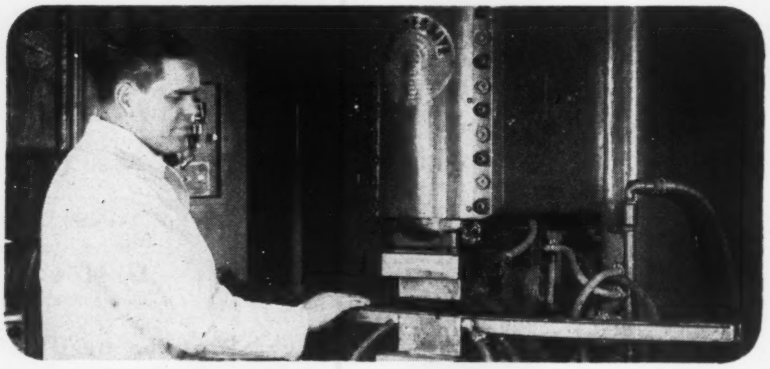
BUT—after Progressive's Process Engineering Department studied the design and recommended a few minor changes in 5 of the stampings—production jumped to 100 per hour—doubling output per machine hour and cutting assembly cost in half.

Those simple changes made it possible to assemble each of the five largest stampings to the bus pillars proper with just one projection welding operation on each part—five operations instead of 33!!

That's why it pays to call in Progressive's Process Engineering Department. We will be glad to work with you, too.


~~7-SPOTS~~
1 PROJECTION WELD
~~6-SPOTS~~
1 PROJECTION WELD
~~6-SPOTS~~
1 PROJECTION WELD
~~8-SPOTS~~
1 PROJECTION WELD
2-SPOTS
~~6-SPOTS~~
1 PROJECTION WELD
4-SPOTS EACH
4-SPOTS EACH
4-SPOTS EACH

Producing 50 bus pillars an hour from these stampings with 59 spot welds was *good* production. Getting 100 an hour with 5 projection and 26 spot welds was better.



Here the center bracket is being welded (at eight projections at one time) with a single shot in a Progressive Press Welder.

IT PAYS TO WELD

Booth 1242 at the Metals Show, Chicago

CABLE ADDRESS "PROGWELD"

MEMBER RESISTANCE WELDER MANUFACTURERS' ASSOCIATION RWMA

PROGRESSIVE *Welder Co* 3050 E. OUTER DRIVE • DETROIT 12

RESISTANCE WELDING EQUIPMENT

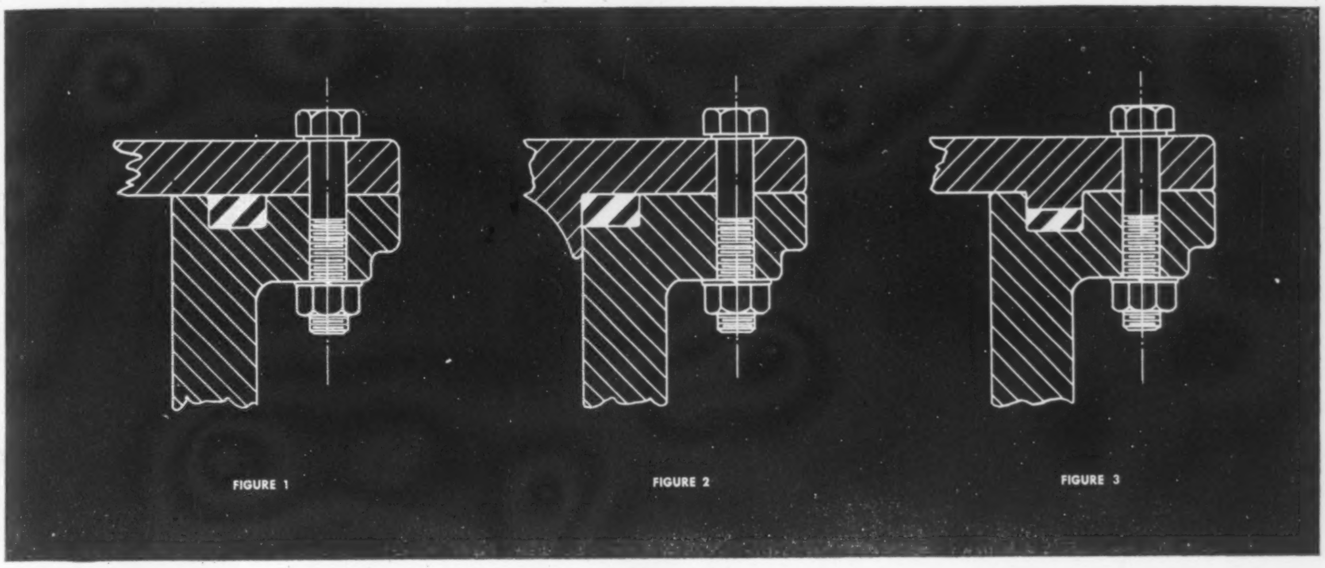


FIGURE 1 FIGURE 2 FIGURE 3

DESIGNING RIGID GASKETED JOINTS

Truly Compressible Gaskets Simplify Metal-to-Metal Construction

Where internal parts are positioned by the removable portion of a housing, the use of simple flat flanges may prove impractical. Because the distance between flanges varies with bolting force, angular and parallel misalignment is possible even though bolts are tight. Positive alignment may be secured, in such cases, by a metal-to-metal flange design.

Metal-to-metal flanges are especially useful in assemblies requiring multiple gasketed joints. Here the problem obviously is to prevent excessive build-up of tolerances. Metal-to-metal joints do this. They also maintain absolute rigidity as well as alignment.

Illustrated in the panel above are three metal-to-metal joints. Figure 1 shows a joint with plain flanges, one of which is grooved to take the gasket. The joint in figure 2 shows another way to reduce movement. Figure 3 illustrates yet a different joint to insure alignment. This particular joint is satisfactory for sealing higher pressures.

When design considerations make it necessary to have a metal-to-metal joint, correct compression of the gasket and complete filling of the groove are necessary. A sealing material is required in which both compressibility and side flow are controlled.

A non-compressible material like straight rubber will not work unless a relief is provided for side flow or uneconomical tolerances are held in both gaskets and metal parts. Without such measures, the rubber may either overflow the channel and prevent the mating of the parts or fail to fill the groove sufficiently to insure a tight seal. Also, the deflection of rubber varies widely depending on its shape, width, and thickness.

A fully compressible material like cork composition has no such variables. Regardless of its shape, width, or thickness, deflection is the same, and displacement occurs only in the direction of the applied load. There is no side flow whatever.

Where the properties of synthetic rubber are needed, similar results can be had with one of Armstrong's cork-and-synthetic-rubber compositions. Combining calculated amounts of rubber and cork, these compositions offer predetermined degrees of compressibility and flow. Groove width and depth tolerances may be wide because these compositions seal effectively with a compression range of 25% to 33⅓%.

We suggest that you discuss your sealing problems with an Armstrong representative. Methods and materials that he may suggest may help further to simplify construction and reduce costs.

If you prefer, send drawings and details to us for review. You'll find our recommendations unbiased and keyed to good current gasketing practice.

ARMSTRONG'S GASKET AND SEALING MATERIALS
ARMSTRONG CORK COMPANY

SEND FOR FREE BOOKLET

Write for the new, 20-page 1947 edition of "Armstrong's Gasket and Sealing Materials." It includes specification data on more than 40 of Armstrong's resilient sealing materials and also helpful hints on their proper application. Write today to Armstrong Cork Company, Gaskets and Packings Department, 5110 Arch Street, Lancaster, Pa.

ARMSTRONG'S
GASKETS · SEALS · PACKINGS

Cork Compositions • Cork-and-Synthetic-Rubber Compositions
Synthetic Rubber Compounds • Cork-and-Rubber Compositions
Fiber Sheet Packings • Rag Felt Papers • Natural Cork

FELT SEALS RETAIN LUBRICANTS, EXCLUDE DUST

Two Basic Types of Felt Seals, Applicable in a Wide Variety of Designs, Solve Most Sealing and Packing Problems

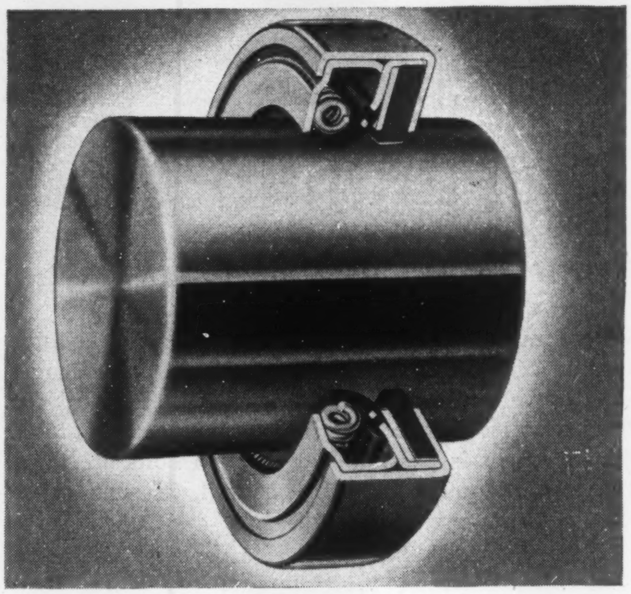
The unusual and unique properties of felt make it especially valuable in sealing and packing applications. Such uses are increasing steadily, as more and more engineers and designers appreciate the simplicity of application, reliability of performance, and long life of felt. For any machines in which it is necessary to retain bearing lubricants, and feed them automatically and uniformly as needed, or from which dust, fumes, or moisture must be excluded, felt seals and packings merit your consideration.

PHYSICAL CHARACTERISTICS

The chief physical characteristics of felt that make it so highly suitable for seals are absorption capacity, low coefficient of friction, and resiliency. Oil absorption capacity is high, and is largely a function of felt density. Table 1 gives the absorption values of American Felt Company's standard S.A.E. felts for a range of commercial grade lubricating oils. However, any type of felt suitable for sealing purposes generally holds enough oil to give reliable performance without attention between major overhauls. The coefficient of friction averages 0.22 for dry felt against steel, which is reduced to 0.15 when the felt is pre-saturated with oil of 41.2 Saybolt viscosity at 210°F. Because of its resilience, felt maintains a constant sealing pressure regardless of wear, end-play, minor misalignment or out-of-round conditions of metal shafts and assemblies. Another important advantage of felt is that if it should run dry as a result of operation past the time for overhaul, it tends to polish rather than score a shaft. Under normal bearing temperatures and speeds, felt will never fail through aging, embrittlement, or disintegration.

TWO TYPES OF SEALS

Plain Felt Seals. These are precision-cut washers, produced by American Felt Company, with a tolerance of .005". They are cut from standard types of S.A.E. Felt, and may be pre-saturated with lubricant before assembly. The lubricant employed is generally one higher in viscosity than that which is to be retained. Such seals have only two limitations: they should not be used to retain oil of extremely low viscosity, nor to retain pressurized lubricants. For such services, the laminated seal is recommended.



Laminated Felt Seals. In these, the plain felt seal is combined with one or more impervious septums of 1/64 to 1/32 inch sheet Hycar. The felt may be of the same density throughout, or felt of different densities may be used on opposite sides of a septum. Thus a laminated seal can have felt of high density and oil retention capacity on one side, and on the other side a lower density felt for dust exclusion. An example of this is seen at (a) in the drawing, which shows a single-unit washer that combines lubricant-retention, sealing, and dust-exclusion.

TABLE 1—OIL ABSORPTION CAPACITY OF SAE FELTS AT 76 F.[2]

SAE No.	Felt Density Per cent Specific Gravity	SAYBOLT VISCOSITY[1]						
		35.0	39.6	41.2	46.1	50.7	61.3	77.0
F-1	35.80	165%	157%	170%	161%	173%	179%	155%
F-3	31.00	203%	183%	207%	212%	200%	201%	205%
F-5	25.90	238%	225%	244%	249%	241%	244%	252%
F-7	26.70	232%	206%	221%	252%	241%	233%	227%
F-10	18.70	427%	450%	464%	456%	476%	470%	476%
F-11	19.45	387%	382%	352%	341%	367%	461%	354%
F-13	17.40	376%	359%	378%	378%	394%	384%	392%
F-15	18.45	334%	331%	334%	349%	353%	348%	363%

[1] Saybolt Viscosities at 210 F.
[2] Per Cent Weight Increase at Saturation Point as determined by Volume Displacement Method at 76 F.

The impervious septum may also be on only one side of the washer, as in (b). The multiple laminations of (c) to (e) inclusive are further modifications, developed for progressively more difficult mechanical sealing operations. In each case, the impervious layer of oil-resistant Hycar functions as a positive dam against low viscosity lubricants. These seals will also withstand a moderate amount of lubricant pressure.

IMPREGNANTS

Both plain and laminated felt seals may be impregnated with standard grades of oils and greases, or special treatments may be used to meet unusual conditions. For minimum friction, micronized graphite is employed. For pressurized service, or to exclude water or mud, impregnations of paraffin, petrolatum, or graphite are sometimes used, as in marine stuffing boxes and plunger valves, and in other critical sealing applications. The versatility of felt for sealing purposes is one of its important advantages.

DESIGN CONSIDERATIONS

Both plain and laminated felt seals have a rectangular cross section. The inside diameter of the washer is from 0.005″ to 0.030″ less than the outside diameter of the shaft over which it is to fit, depending upon the type and density of the felt specified. Thickness of the washer also depends upon the type of felt, and increases with shaft diameter. Some typical designs are shown in Fig. 2.

Turned or cored housings are preferably designed with tapering sides in the form of an isosceles trapezoid with the sides inclined from 4° to 7°. This taper serves to compress the washer radially inward, effecting a constant pressure on the shaft. In the case of exterior glands or packing plates where the design requires that one wall be at right angles to the shaft, the inner wall of the housing should be inclined.

SELECTION

Felt seals, plain or laminated, are recommended where operating temperatures lie between −60° and 250°F. and where peripheral shaft speeds do not exceed 2000 feet per minute. Since felt is an engineering material, thoroughly understood and standardized, selection of the proper type to meet any given conditions within the above range can be made with complete confidence. In general, S.A.E. F-1, F-2 and F-3 felts are used for difficult oil or grease retaining conditions, with shaft speeds over 1000 feet per minute. S.A.E. F-5, F-6 and F-7 felts are employed for lubricant-retaining washers at shaft speeds between 750 and 1000 feet, and also for difficult excluding conditions at speeds over 1000 feet. S.A.E. F-10, F-11, F-13 and F-15 felts are suitable for lubricant retention at shaft speeds less than 750 feet per minute, and as dust-excluding washers, for shaft speeds less than 1000 feet per minute. S.A.E. F-50 felt is employed in precision ball bearing seals.

FORMS

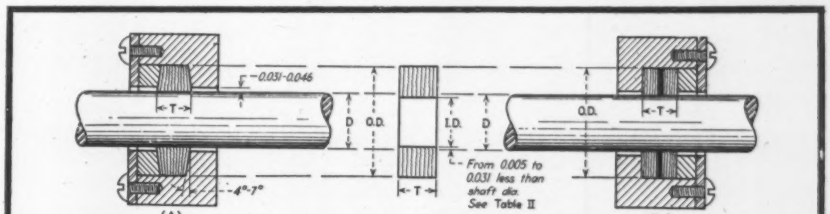
American Felt Company supplies felt for seals either in roll or sheet form, or cut into washers to your specifications. This felt is in abundant supply, uniform in quality as to each type, deliveries are prompt, and in most cases the felt washers are the lowest-cost parts of a given machine or assembly.

COLLABORATION

American Felt Company engineers will gladly collaborate with you in such matters as design of seals and selection of the proper type of felt. The material in this advertisement is a condensation of data given in American Felt Company Data Sheet No. 11, "Felt Seals, Their Design and Application." This contains additional technical information, such as tables showing oil absorption capacity and dimensional tolerances and degree of housing compression for plain and laminated felt seals. This eight-page Data Sheet is the outstanding paper on this subject. A copy will be sent you if you will write your request on your letterhead.

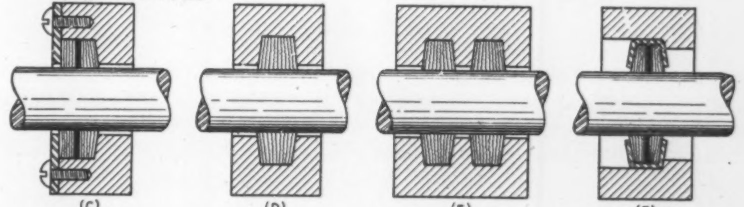
APPLICATIONS
(plain and laminated felt seals)

SAE Felt Grades	Shaft Diameter	Application
F-1 F-2 F-3	0.5″ 1.0″ 1.5″ to 4.0″	Difficult oil or grease retaining conditions and shaft speeds exceeding 1000 feet per minute.
F-5 F-6 F-7	0.5″ 1.0″ 1.5″ to 4.0″	Oil or grease retaining washers for shaft speeds between 750 and 1000 feet per minute. Also, difficult dust-excluding conditions where shaft speeds exceed 1000 feet per minute.
F-10 F-11 F-13 F-15	0.5″ 1.0″ 1.5″ 2.0″ to 4.0″	Oil or grease retaining washers for shaft speeds less than 750 feet per minute. Also, dust-excluding washers for shaft speeds less than 1000 feet per minute.
F-50	....	Precision ball bearing seals.



(A)
PLAIN FELT GREASE OR OIL SEAL
Typical housing wherein a plain felt seal is held in a tapered annular space exerting axial compression at the O.D.

(B)
LAMINATED FELT OIL AND DUST SEAL
Housing with slight axial compression



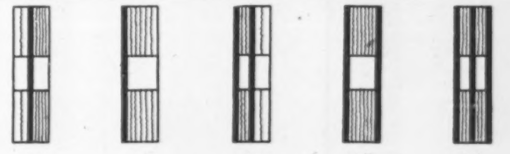
(C)
SINGLE TAPER PRESSURE PLATE WITH LAMINATED FELT SEAL

(D)
DOUBLE TAPER NO PRESSURE PLATE

(E)
DOUBLE WASHER APPLICATION

(F)
SELF-CONTAINED UNIT LAMINATED FELT SEAL

FIG. 2

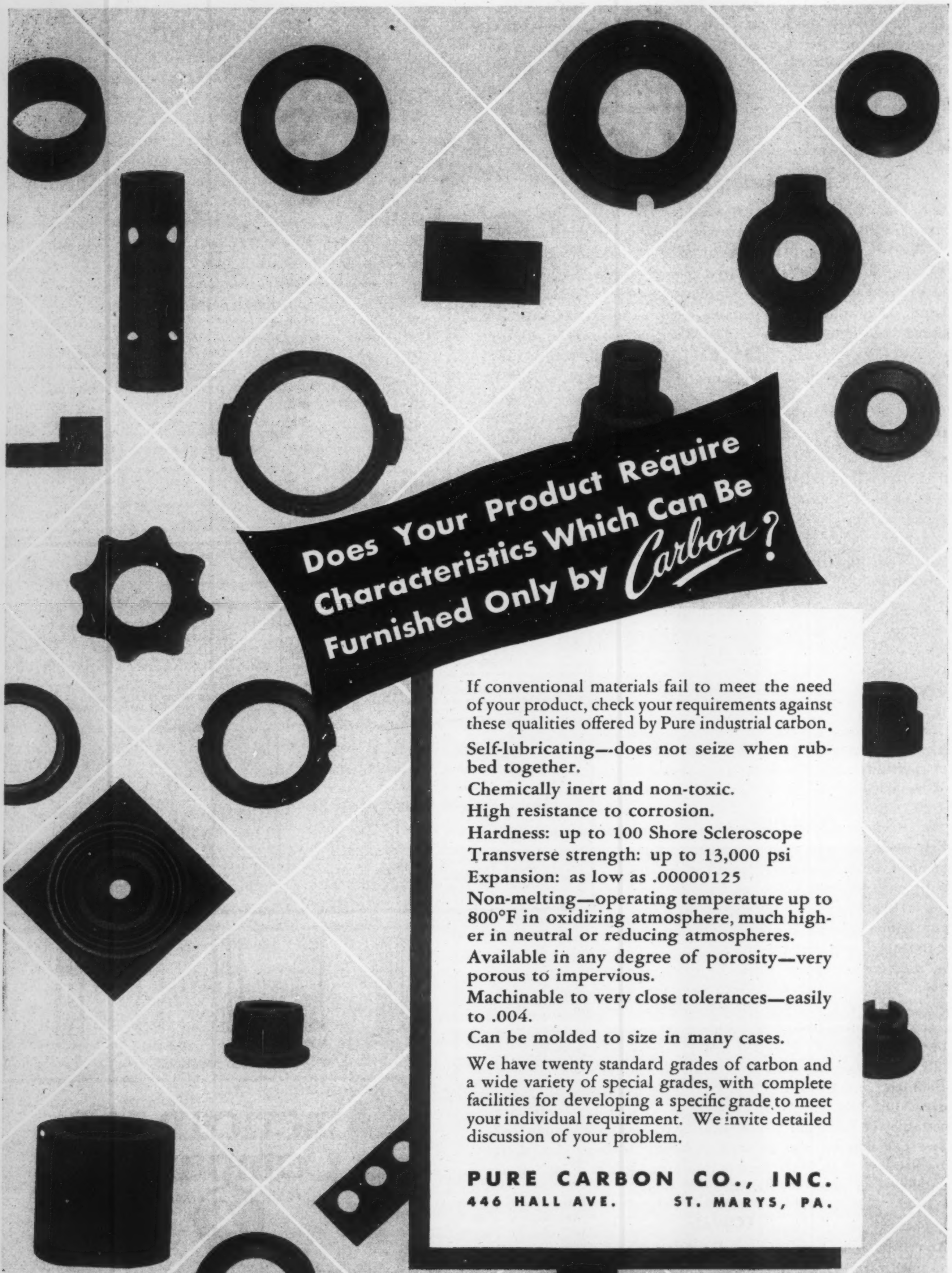


(a) (b) (c) (d) (e)

LAMINATED FELT SEALS

American Felt Company
TRADE MARK

Engineering and Research Laboratories: Glenville, Conn.
PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.
SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, St. Louis, Philadelphia, Atlanta, Rochester, Dallas, San Francisco, Los Angeles, Portland, Seattle, Montreal


Does Your Product Require Characteristics Which Can Be Furnished Only by Carbon?

If conventional materials fail to meet the need of your product, check your requirements against these qualities offered by Pure industrial carbon.

Self-lubricating—does not seize when rubbed together.

Chemically inert and non-toxic.

High resistance to corrosion.

Hardness: up to 100 Shore Scleroscope

Transverse strength: up to 13,000 psi

Expansion: as low as .00000125

Non-melting—operating temperature up to 800°F in oxidizing atmosphere, much higher in neutral or reducing atmospheres.

Available in any degree of porosity—very porous to impervious.

Machinable to very close tolerances—easily to .004.

Can be molded to size in many cases.

We have twenty standard grades of carbon and a wide variety of special grades, with complete facilities for developing a specific grade to meet your individual requirement. We invite detailed discussion of your problem.

PURE CARBON CO., INC.

446 HALL AVE. **ST. MARYS, PA.**

CASTINGS . . . *but they were "machined" in the mold!*

Now—all the advantages of Monel, Nickel and Inconel—available in PRECISION CASTINGS

HERE'S another way to lick tough design problems . . . *precision castings of Monel, Nickel and Inconel.*

The new INCO Precision Castings Plant is now in operation . . . built and equipped after several years of pilot plant study, after thousands of experimental castings.

Check what this development means:

1 **Precision Castings of Precision Accuracy**—INCO precision castings are commonly made to tolerances of ± 0.003", and frequently to even finer tolerances.

2 **A Saving in Time and Money**—In general, INCO precision castings eliminate machining or other fabricating operations normally involved in making parts. This is particularly noteworthy where the design calls for intricate features and contours. INCO precision castings are delivered to you with a sand-blasted finish—and usually that's all the finishing these castings require before being assembled into the finished product.

3 **Broader Use for the INCO Nickel Alloys**—The flexibility of design permits the INCO Nickel Alloys to be used in shapes which frequently were neither economical nor practical to obtain as sand castings or by machining from forged stock or deep forgings.

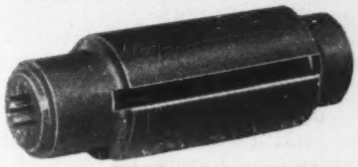
4 **Dependable Source of Supply**—INCO handles precision castings as a mass production process . . . you can count on quick, steady production from INCO.

•

Perhaps an INCO Nickel Alloy precision casting is your answer to the need for faster production...for hardness, greater protection against stress, corrosion, high temperatures, wear and fatigue.

Let's go over your job together. Just send us a blueprint (or an actual sample). We'll be glad to work out all the information you want. *Reg. U. S. Pat. Off.

INCO PRECISION CASTINGS SAVE TIME AND MONEY



FUEL PUMP ROTOR

Would require a number of operations on several different machines. Note grooves on internal surface.

CLUTCH GEAR

Saved complicated machining. Also avoided at least one sub-assembly, i.e., force-fitting, welding or brazing the projecting key on small end.

FLIGHT CONTROL INSTRUMENT COVER

(*Cutaway section*) Originally machined from bar stock, taking a 9-day production schedule. Note intricate recesses and studs in recesses.

Above parts are made of "S" Monel

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N.Y.

EMBLEM OF SERVICE

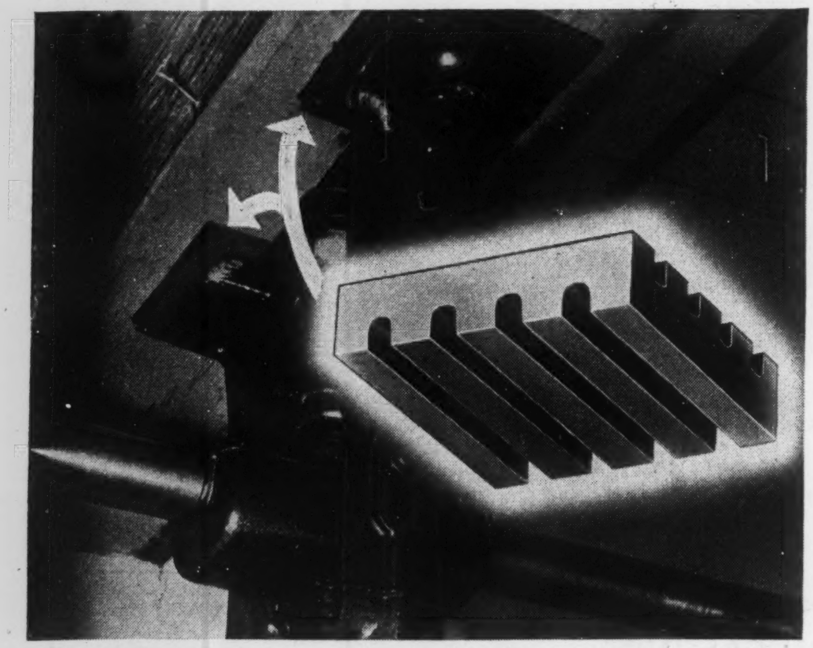
NICKEL INCO ALLOYS

TRADE MARK

MONEL* • "K" MONEL* • "H" MONEL* • "R" MONEL* • "S" MONEL* • INCONEL* • NICKEL • "L" NICKEL* • "Z" NICKEL*

For Resistance To

Oil and Grease
Flex Cracking
Heat and Aging



**...NEW TYPE
VIBRATION
DAMPENERS
USE TOUGH,
RESILIENT**

NEOPRENE

Illustration courtesy M. B.
Manufacturing Co., Inc.,
New Haven, Connecticut

Simple in principle . . . easy to install, these new "Isomode" pads may provide an economical and effective solution to your vibration problems. They have proved effective for business machines, fans, laboratory equipment, instrument panels, and a variety of production equipment, such as punch presses, line shafts, and looms. In tests of an actual installation, the manufacturer reports that the pads have reduced transmitted vibration caused by operating machinery as much as 72%. This means improved working conditions . . . less worker fatigue . . . higher production.

The neoprene compound used in the manufacture of "Isomode" pads effectively absorbs vibration . . . has low permanent set under load. Constant flexing won't crack it. And neoprene lasts because it resists deterioration from heat, and from grease and oil commonly found on shop floors and benches.

When you have a problem involving rubber, look to Du Pont neoprene. We'll be glad to furnish technical information, work with your supplier, or help you find a source for finished neoprene products.

* * *

Have you sent for your free subscription to **The Neoprene Notebook.** *It's full of interesting stories about new or unusual applications of neoprene. And you may find valuable ideas. E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division A10, Wilmington 98, Delaware.*

DESIGN FOR SUCCESS WITH

NEOPRENE

The rubber made by Du Pont

HERE'S WHY NEOPRENE DOES SO MANY JOBS SO WELL!

- ★ High tensile strength, resilience, low permanent distortion.
- ★ Tough and durable, resists abrasion and cutting.
- ★ Superior resistance to sunlight, aging, ozone, and heat.
- ★ Resistance to deterioration by oils, solvents, chemicals, acids.
- ★ Superior air-retention, low permeability to gases and fluids.
- ★ Special compositions are flame-retarding, static-conducting, flexible at low temperatures.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT
REG. U. S. PAT. OFF

Tune in to Du Pont "CAVALCADE OF AMERICA," *Monday nights—8 p. m. EST, NBC*

• ENGINEERED AND MOLDED AT NO. 1 PLASTICS AVENUE

PROBLEM—
MOLD PLASTICS BOAT—
MUST BE DURABLE, LIGHT,
RESISTANT TO SALT WATER.
4'2½"

Plastics ride the waves

○ First of its kind! It's a one-piece all-plastics dinghy—produced by General Electric for the Beetle Boat Company, New Bedford, Massachusetts. A single giant mold forms the entire nine-foot boat in one unit. General Electric engineers specified the particular plastic materials that make this unique boat leakproof, light, and buoyant . . . yet so strong and tough that it withstands amazing abuse. And it requires no maintenance!

This is just one more example of what General Electric's *complete* plastics service can accomplish. G.E. is equipped to design, engineer, and mold plastics parts to meet the individual requirements of your particular job.

So when you think of plastics, think of General Electric, world's largest manufacturer of finished plastics products. *Write for your free copy of the interesting booklet, illustrated in color, called "Problems and Solutions in Plastics."* Address Plastics Division, Chemical Department, General Electric Company, 1 Plastics Avenue, Pittsfield, Massachusetts.

G-E Complete Service—Everything in Plastics

BACKED BY 53 YEARS OF EXPERIENCE. We've been designing and manufacturing plastics products ever since 1894. G-E research works continually to develop new materials, new processes, new applications.

NO. 1 PLASTICS AVENUE—complete plastics service—engineering, design and mold-making. Our own industrial designers and engineers, working together, create plastics parts that are both scientifically sound and good-looking. Our own toolrooms are manned by skilled craftsmen—average precision mold experience, 12 years.

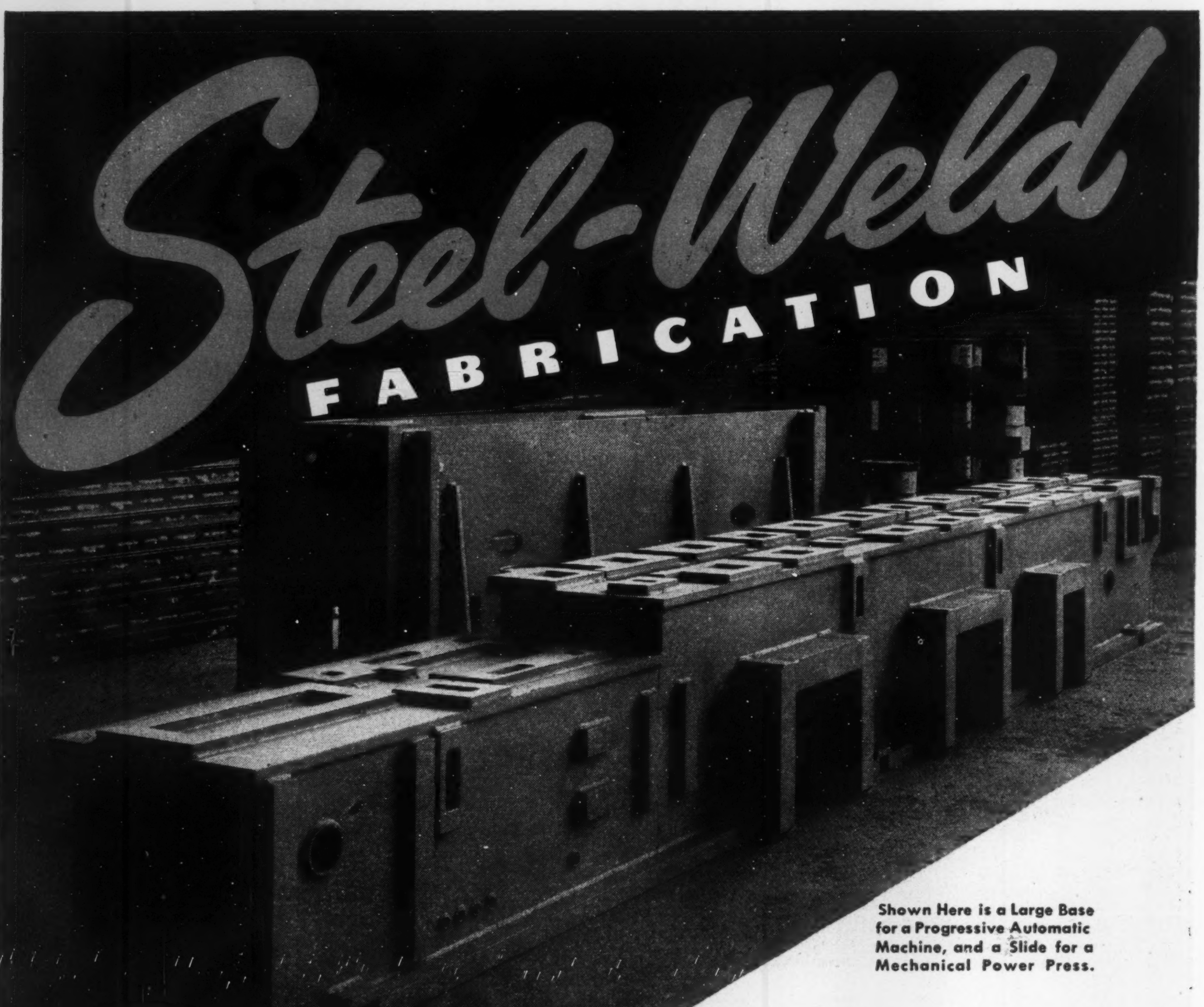
ALL TYPES OF PLASTICS. Facilities for compression, injection, transfer and cold molding . . . for both high and low pressure laminating . . . for fabricating. And G-E Quality Control—a byword in industry—means as many as 160 inspections and analyses for a single plastic part.

GENERAL ELECTRIC

CD47-H-3

EVERYTHING IN Plastics

GENERAL ELECTRIC PLASTICS FACTORIES ARE LOCATED IN SCRANTON, PA., MERIDEN, CONN.,
COSHOCTON, OHIO, FORT WAYNE, IND., TAUNTON AND PITTSFIELD, MASS.



Steel-Weld FABRICATION

Shown Here is a Large Base for a Progressive Automatic Machine, and a Slide for a Mechanical Power Press.

Your welded steel requirements may be something entirely different from the Machine Bases illustrated here . . . but, regardless of design, shape, size, or weight, the Mahon organization stands ready to handle your particular requirements promptly and efficiently. Complete and modern facilities for Cutting, Forming, Welding, Normalizing, Stress Analysis, Sandblasting, Machining and Painting make for economy in production, and a staff of thoroughly competent design engineers and highly skilled workmen are your assurance of every advantage of Steel-Weld Fabrication.

Address STEEL-WELD DIVISION
THE R. C. MAHON COMPANY
DETROIT 11, MICHIGAN

Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

MAHON

ORCO Rubber Products

Typical Products Made by "OHIO RUBBER CO."

AUTOMOTIVE PARTS

- Boots
- Bumpers
- Channels
- Fender Guards
- Gaskets
- Grommets
- Mats: Contour
- Mats: Flat
- Mats: Carpet Inserted
- Pedal Pads
- Running Boards
- Sill Mats
- Step Plates
- Tubing
- Weatherstrips
- Wiper Blades

RUBBER-TO-METAL

- Beater Bars (Farm Mch'y)
- Bumpers
- Pedal Pads
- Running Boards
- Sill Mats
- Step Plates
- Tractor Shoe Blocks

RUBBER BONDED TO:

- Aluminum 2S and 3S
- Black Iron
- Brass 70/30, or less
- Bronze
- Cadmium Plate
- Cast Iron
- Chromium Plate
- Copper
- Dow Metal
- Galvanized Iron
- Lead
- Stainless Steel
- Terne Plate
- Zinc
- Carbon
- Wood
- Fibre (Vulcanized)
- Celotex
- Glass
- Plastics

HOSE (All Rubber)

- Drain
- Heater
- Washing Machine

MOLDED GOODS

- Boots
- Bumpers
- Conductive Rubber
- Diaphragms
- Gaskets
- Grommets
- Gun Recoil Pads
- Laminated Door Panels for Refrigerators
- Milking Machine Inflations
- Oil Well Supplies
- Screw Bumpers
- Small Hard Rubber Parts
- Treadles
- Valve Cups
- Valve Discs

EXTRUDED GOODS

- Bumpers
- Channels
- Gaskets
- Glass Setting Strips
- Rollers
- Tiring
- Tubing
- Weatherstrips

HARD RUBBER

- Casters (Light Duty)
- Casters (Heavy Duty)
- Handles
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- Toys
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RUBBER ROLLERS

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- Ladder
- Scale
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DEFROSTER AND VENTILATING HOSE

Full range for length and O.D.

VIBRATION ABSORPTION AND MOUNTINGS

- Engine
- Machinery
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- Vibration Absorption and Isolation Parts

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All sizes and shapes to customer's specifications

GRIPS

- Bicycle
- Control Rod
- Fishing Rod
- Lawn Mower
- Motorcycle
- Outboard Motor
- Scooter
- Tricycle
- Tubular
- Vacuum Sweeper
- Velocipede
- Wagon

SEALS

- Dirt
- Grease
- Oil
- Silicone
- Water Pump

WHEELS

- Casters (Light Duty)
- Casters (Heavy Duty)
- Industrial Wheels (Molded and Pressed)
- Toys

TIRES
(Solid Molded)

- Automobile (Junior)
- Baby Carriage
- Caddy Cart (Golf)
- Coaster Wagon
- Garden Cart
- Hand Trucks, Etc.
- Industrial Vehicles
- Lawn Mower
- Misc. Portable Equipment
- Scooter
- Toy
- Velocipede

AIR KING TIRES
(Semi-Pneumatic)

Light Duty

Sizes from 8″ x 1.25″ to 20″ x 1.75″

Typical Applications:

- Automobiles (Junior)
- Baby Carriages
- Caddy Carts (Golf)
- Coaster Wagons
- Garden Carts
- Hand Trucks, Etc.
- Industrial Vehicles
- Lawn Mowers
- Misc. Portable Equipment
- Scooter • Toys
- Velocipedes

Heavy Duty

Sizes from 6″ x 2.00″ to 16″ x 4.00″ with respective load ratings from 150 lbs. to 625 lbs. Other sizes and load ratings made to specifications.

Typical Applications

- Aisle Marking Machines
- Arc Welding Machines
- Barrel and Drum Trucks
- Battery Charging Machines
- Car Washers
- Contractors' Pumps
- Cooling Fans
- Floor Sweeping Machines
- Hand Trucks
- Hospital Equipment
- Insecticide Sprayers
- Lubricating Equipment
- Paint Sprayers
- Tote Trucks
- Traffic Line Markers
- Sidewalk Snow Plows
- Wheelbarrows
- Misc. Portable Equipment

TIRES
(Extruded Tubing)

- Automobile (Junior)
- Baby Carriage
- Caddy Cart (Golf)
- Coaster Wagon
- Garden Cart
- Hand Trucks, Etc.
- Industrial Vehicles
- Lawn Mower
- Misc. Portable Equipment
- Scooters • Toys
- Velocipede

FACTORIES:
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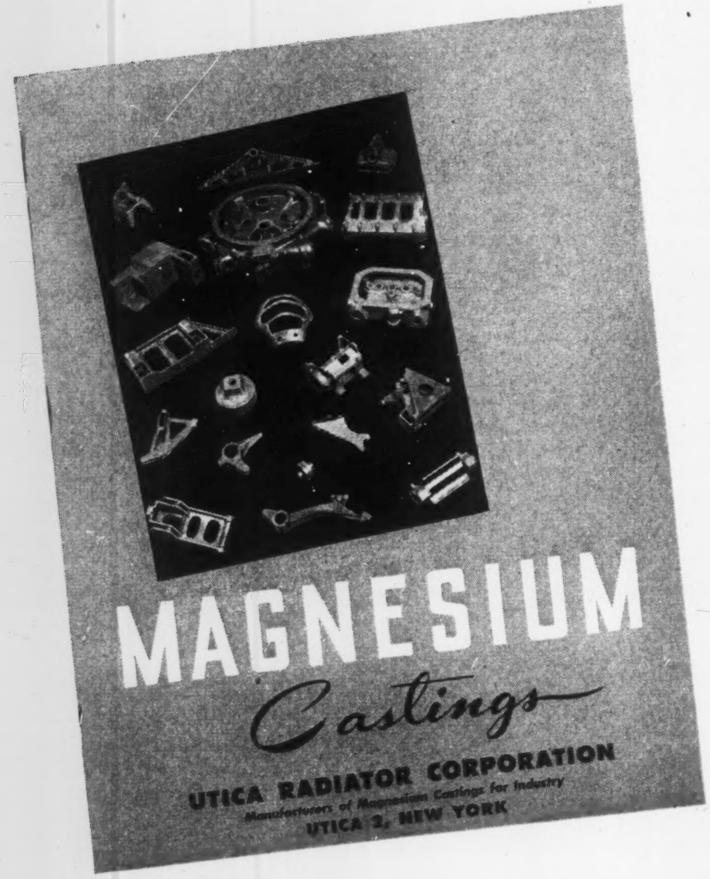
MAGNESIUM

The Lightweight Champ

CAN LICK YOUR PRODUCTION COSTS



MAGNESIUM

Castings

UTICA RADIATOR CORPORATION

Manufacturers of Magnesium Castings for Industry

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Magnesium Castings are star performers . . . lightweight, easy to machine, yet with the strength and rigidity you may be looking for in your product! For low-cost, high-quality production . . . look to Magnesium—and Utica Radiator's complete facilities for the manufacture of Magnesium sand castings—including laboratory control, heat-treating, core-making, molding, and finishing!

Our NEW BOOKLET answers your questions about MAGNESIUM

It's the factual story about Magnesium . . . and shows through pictures how Utica Radiator meets the demands of modern industry for reduced production costs and product appeal—with this lightweight, modern metal!

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UTICA PRODUCTION FACILITIES ASSURE QUALITY CASTINGS

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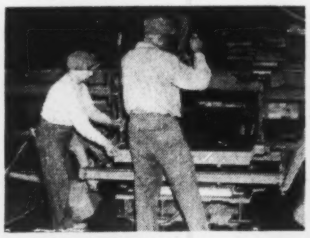
Constant analysis by our Chemical, Mechanical, and Metallurgical laboratories assures consistent quality in Utica Radiator products.



Complete Foundry Production Equipment

Wide Variety of molding equipment provides ample facilities for high quality, high production foundry operations—at low cost!

Utica Radiator Corporation

Manufacturers of Magnesium Castings for Industry

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NATIONAL VULCANIZED FIBRE COMPANY

WILMINGTON, DELAWARE

Since 1873

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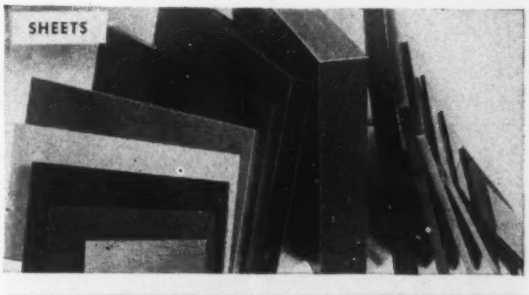
ROCHESTER . . . . 725 Powers Bldg.
ST. LOUIS . . . . 4903 Delmar Blvd.
SAN FRANCISCO . . . 273 Seventh St.
SEATTLE . . . . . 1927 First Ave., S.

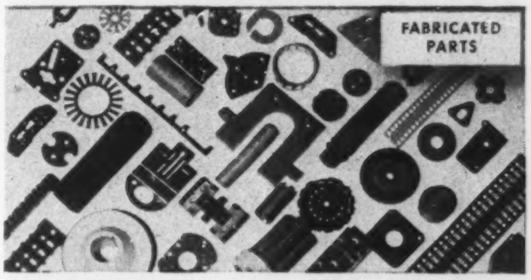
NATIONAL LAMINATED PLASTICS

PROVIDE THE ELECTRONICS INDUSTRY WONDERFUL OPPORTUNITIES FOR PROFITABLE, EFFICIENT PRODUCTS

NATIONAL and the electrical industry have grown hand in hand. Back in 1873, National Vulcanized Fibre as an insulation material helped the budding electrical industry emerge from its embryonic stage into a full-fledged economic necessity. In 1901, National developed Peerless Insulation, the first fish paper, a "must" since that time for electrical insulation.

With the development of Bakelite resins, it was only natural that National, with its broad experience in laminated plastics, should produce Phenolite, which has become a standby in the electrical industry. Thus, National offers three superior materials for electrical insulation which are helping to create better, more efficient and more economical products.



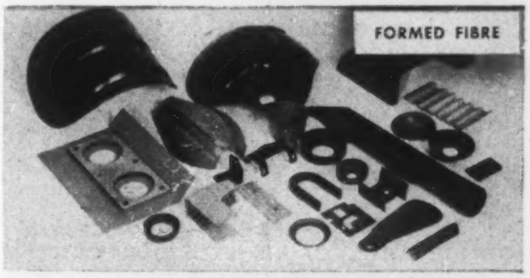


NATIONAL VULCANIZED FIBRE

National Vulcanized Fibre, a tough, hornlike material, possesses excellent electrical properties and great mechanical strength. It is a converted cotton cellulose which is chemically changed into a new structural form having high dielectric strength, excellent machinability, good forming qualities, great resistance to wear and abrasion, long life and light weight. Standard colors are red, black and gray—in 15 basic grades. (*Send for further literature*)

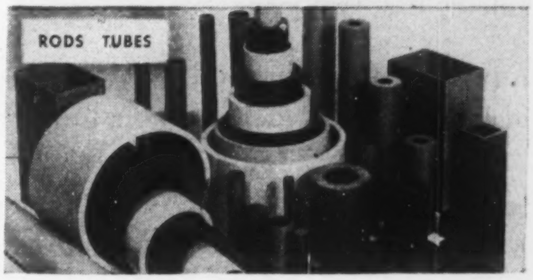
PHENOLITE Laminated PLASTIC

Phenolite, Laminated Plastic, is bonded into its primary forms—sheets, rods, and tubes—under heat and pressure. It has an unusual combination of properties . . . a good electrical insulator, great mechanical strength, high resistance to moisture; ready machinability. Standard colors are natural, black and chocolate; mirror, semi-gloss and dull finishes. (*Send for further literature*)

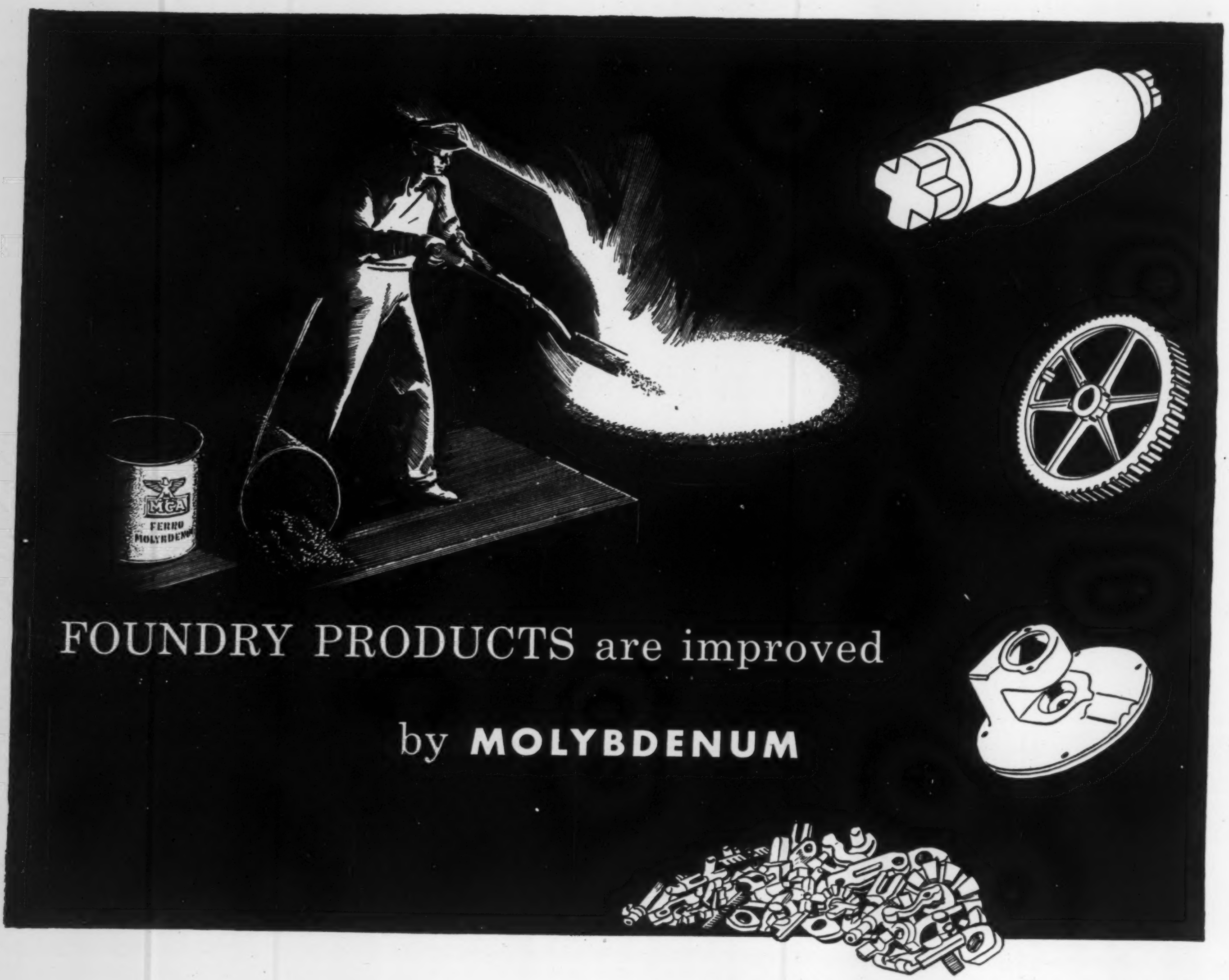


PEERLESS INSULATION

Peerless Insulation, the first fish paper—developed for electrical insulation and accepted by the industry because it is strong, smooth, flexible and has excellent forming qualities. It is uniform in thickness; has high dielectric strength. Made in sheets, rolls and coils in all practical widths and thicknesses.



Experimental service is offered from our research laboratories. National Service Engineers will, without obligation, assist you in employing National Laminated Plastics to your best advantage.



Where high strength is required, and especially strength at high temperatures . . .

Where uniform strength in light and heavy sections is important . . .

And where economy of weight, dimension, or basic materials is a ruling consideration . . .

Molybdenum is entering more and more into the composition of modern castings.

A wide range of physical properties is obtainable by heat treatment.

Advanced formulas and foundry procedures make a little Molybdenum go a long way.

The Molybdenum Corporation, as a supplier of Molybdenum, Tungsten and Boron, is glad to be consulted by any user of these products.

MASTER
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AMERICAN Production, American Distribution, American Control, Completely Integrated.

Offices: Pittsburgh, New York, Chicago, Cleveland, Detroit, Los Angeles, San Francisco, Seattle.

Sales Representatives: Edgar L. Fink, Detroit; Brumley-Donaldson Co., Los Angeles, San Francisco, Seattle.

Subsidiaries: Cleveland-Tungsten, Inc., Cleveland, O.; General Tungsten Mfg. Co., Inc., Union City, N.J.

Works: Washington, Pa.; York, Pa.

Mines: Questa, New Mexico; Urad, Colorado.

MOLYBDENUM **CORPORATION OF AMERICA**
GRANT BUILDING **PITTSBURGH, PA.**

MCA

Specified on the NIAGARA SPRAY COOLER

LORD FLEXIBLE COUPLINGS

. . . provide smooth, quiet, dependable pump drives for Niagara Blower Co., refrigeration equipment—

Reliability and freedom from maintenance feature the Niagara Spray Cooler shown here. Naturally, Niagara Blower Co. specifies these same features in vital parts . . . and they're reasons too why Lord Flexible Couplings are used in their spray pump drives.

Like Niagara, when you specify Lord Flexible Couplings in *your* product, you get unusual flexibility that cushions starting torque and torsional vibration . . . quiet performance—without noise transmission . . . long life —no lubrication required . . . all *plus-values* for your customers in smooth power transmission and trouble-free service.

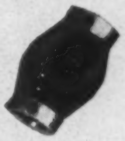
Whether you make refrigeration equipment or something else, you'll want the longer life, the smooth, quiet performance, *and the increased sales* which Lord Flexible Couplings and Mountings can bring to your product . . . through elimination of costly, destructive vibration and noise.

It will pay you to consult Lord . . . let us give you the advantages of a Lord Vibration Control System engineered to your requirements. Write or phone us today.

What about your product . . . ? Is vibration costing you lost sales . . . ? Specify a LORD VIBRATION CONTROL SYSTEM in your product, increase your product sales.

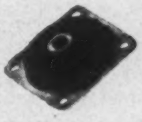
LORD Complete Vibration Control Systems for Refrigeration and Air Conditioning Equipment

• for drives



Besides Lord fractional-horsepower Flexible Couplings illustrated, Couplings also are available for power transmission above 1 HP.

• for motor and compressor mountings

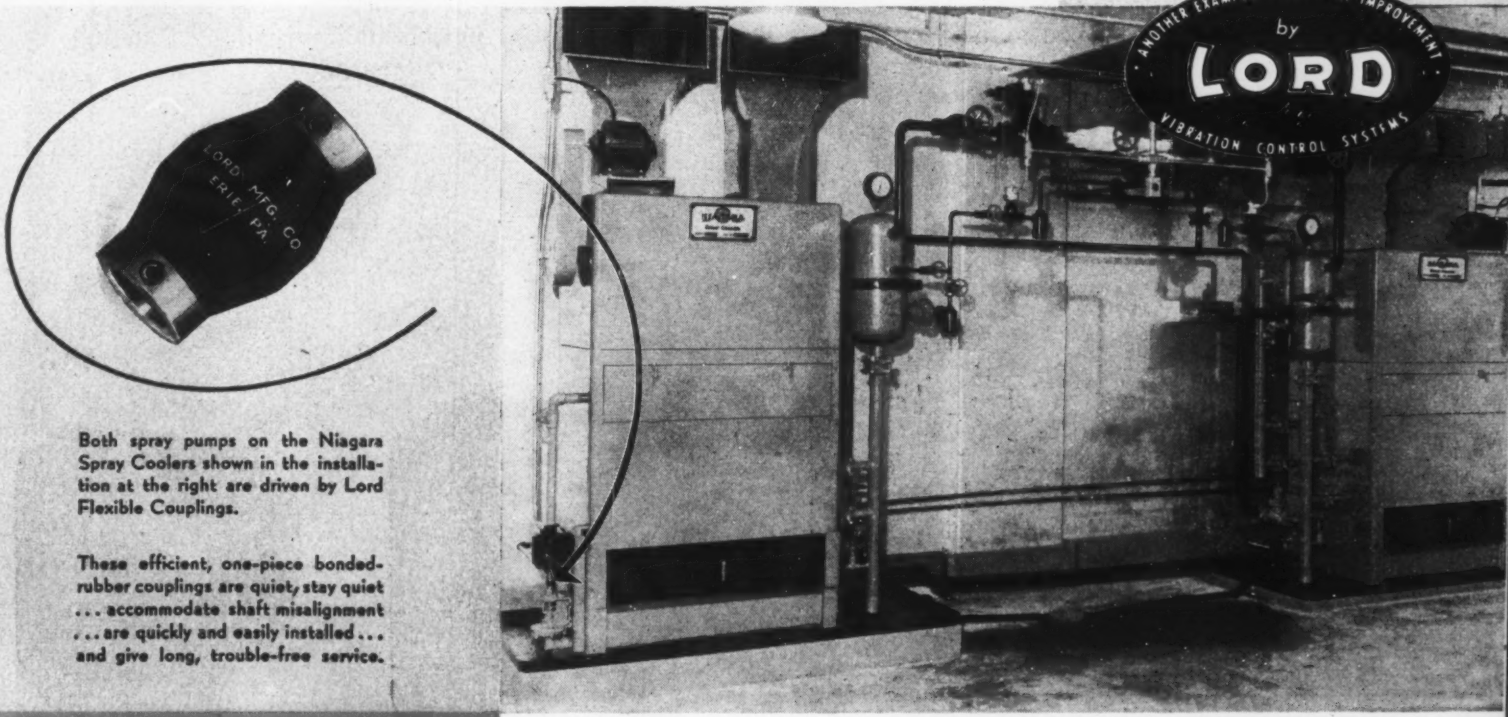


Lord Plate Form Mountings are simple, inexpensive and easy to install. Used for isolation of vibration from light and medium-weight equipment.

For mobile equipment subject to transient shock, progressive snubbing in addition to ability to isolate vibration is obtained with Lord Vertical Snubbing Plate-Form Mountings.

Lord Standard Tube-Form Mountings support heavier loads and provide greater radial stiffness for isolation of continuous vibration.

Where transient shock is encountered, Lord Vertical Snubbing Tube-Form Mountings are used to support heavy equipment and provide progressive snubbing.



LORD MFG. CO ERIE, PA.
ANOTHER EXAMPLE OF PRODUCT IMPROVEMENT by LORD VIBRATION CONTROL SYSTEMS

Both spray pumps on the Niagara Spray Coolers shown in the installation at the right are driven by Lord Flexible Couplings.

These efficient, one-piece bonded-rubber couplings are quiet, stay quiet . . . accommodate shaft misalignment . . . are quickly and easily installed . . . and give long, trouble-free service.

LORD

MAKE GOOD PRODUCTS *BETTER*

WITH *Vibration Control*

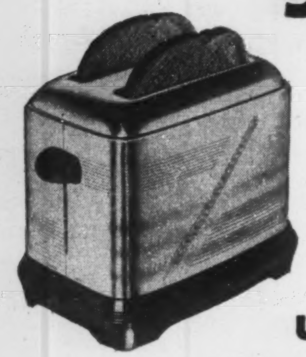
LORD MANUFACTURING CO. · ERIE, PA.

Field Offices: Detroit • Chicago • New York • Washington, D.C.
Providence, R. I. • Burbank, Cal. • Philadelphia, Pa.
Canadian Representative: Railway & Power Engineering Corp., Ltd.

graphitar guide bushings

(CARBON-GRAPHITE)

toaster pop up toast "just you like it!"

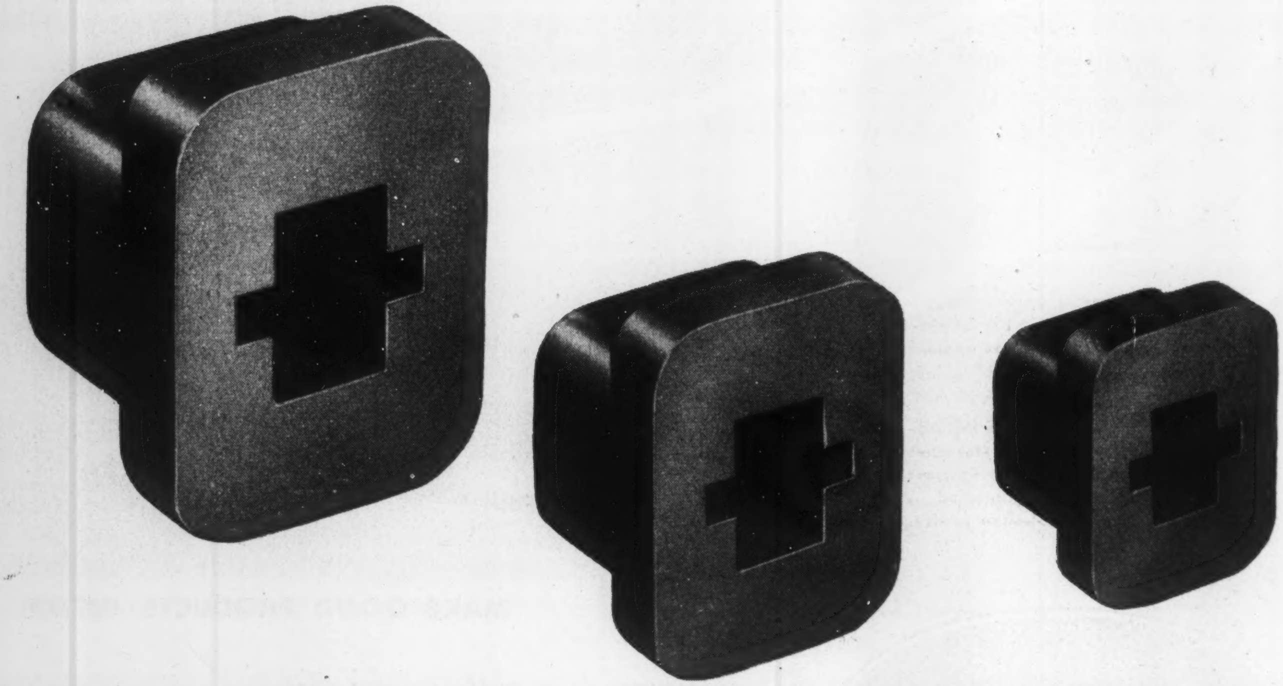


PROCTOR ELECTRIC COMPANY USES GRAPHITAR GUIDE BUSHINGS TO ASSURE SMOOTH SLIDING OF BREAD PLATFORM PAST TOASTER HEATING COILS

The Proctor Automatic Toaster turns out *delicious slices of uniform toast,* partly because the platform that holds the slice of bread slides smoothly on 4 Graphitar guide bushings. Installed as illustrated, these Graphitar bushings *run freely in the slots,* keeping the platform at an even level—as it raises and lowers.

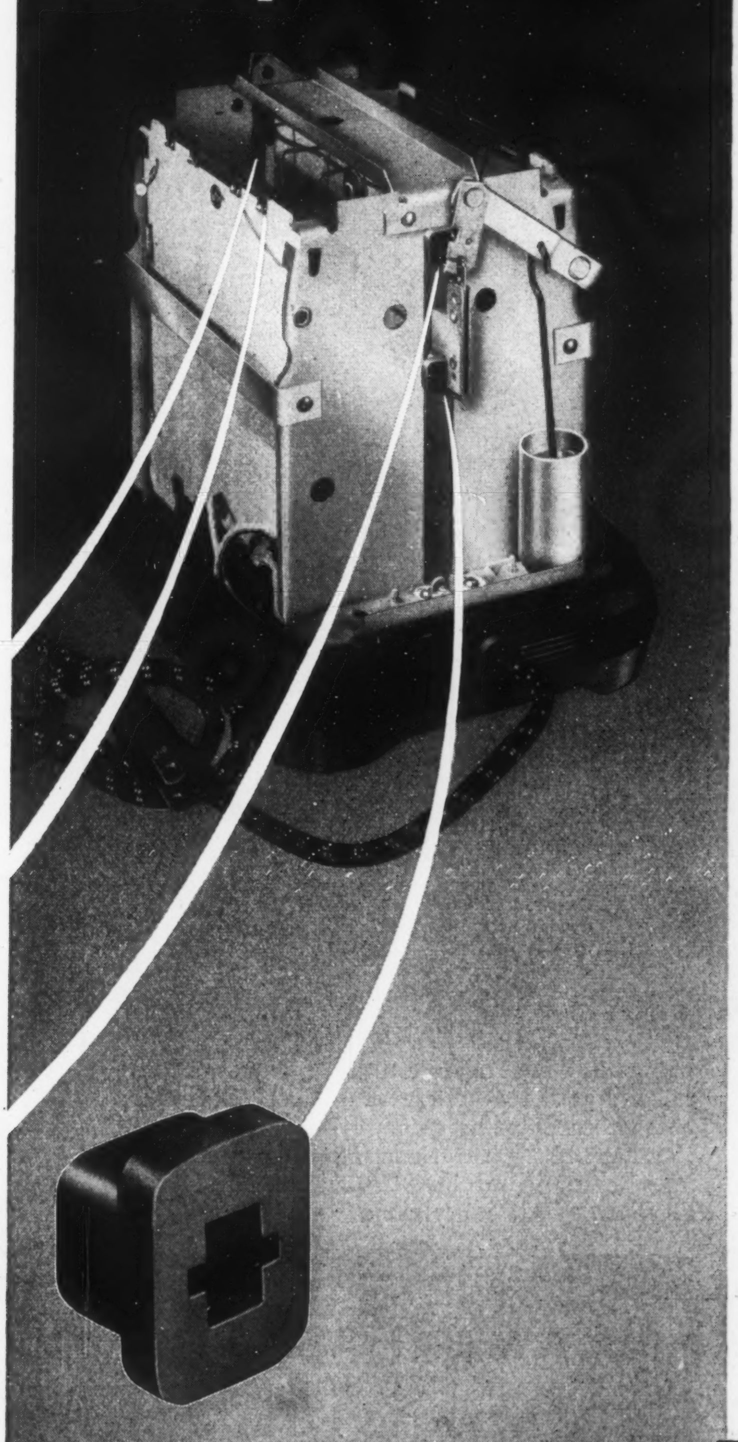
No lubrication of these bushings is ever necessary, because Graphitar is self-lubricating. They operate noiselessly, they withstand the heat for prolonged periods with no distortion or other ill effects, and they contribute a large measure of dependability to help make the Proctor Automatic Toaster one of the most popular appliances in modern homes.

Send us sketches of your products. Our engineers may be able to save you money by showing you where Graphitar parts will improve mechanical performance at less cost. *Write today for 44-page illustrated catalog.*



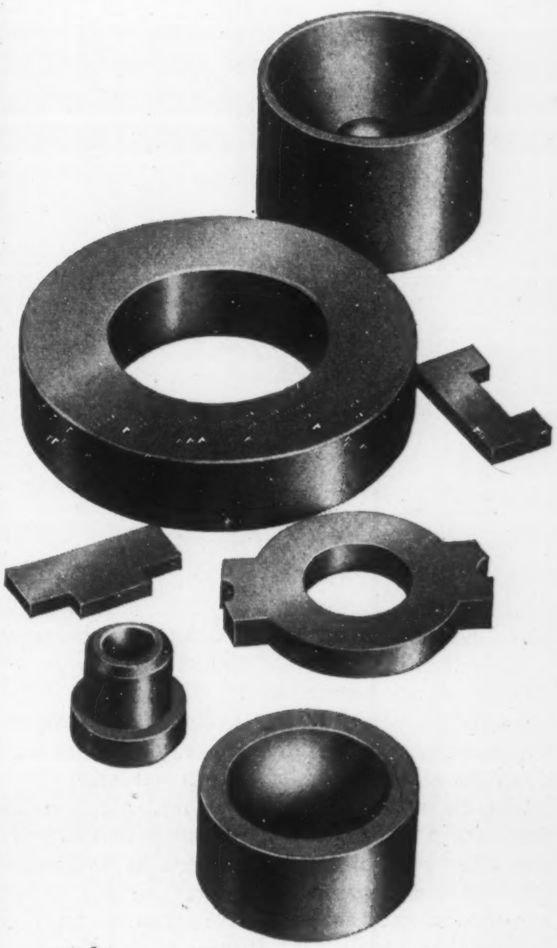
THE UNITED STATES GRAPHITE

help automatic
the way



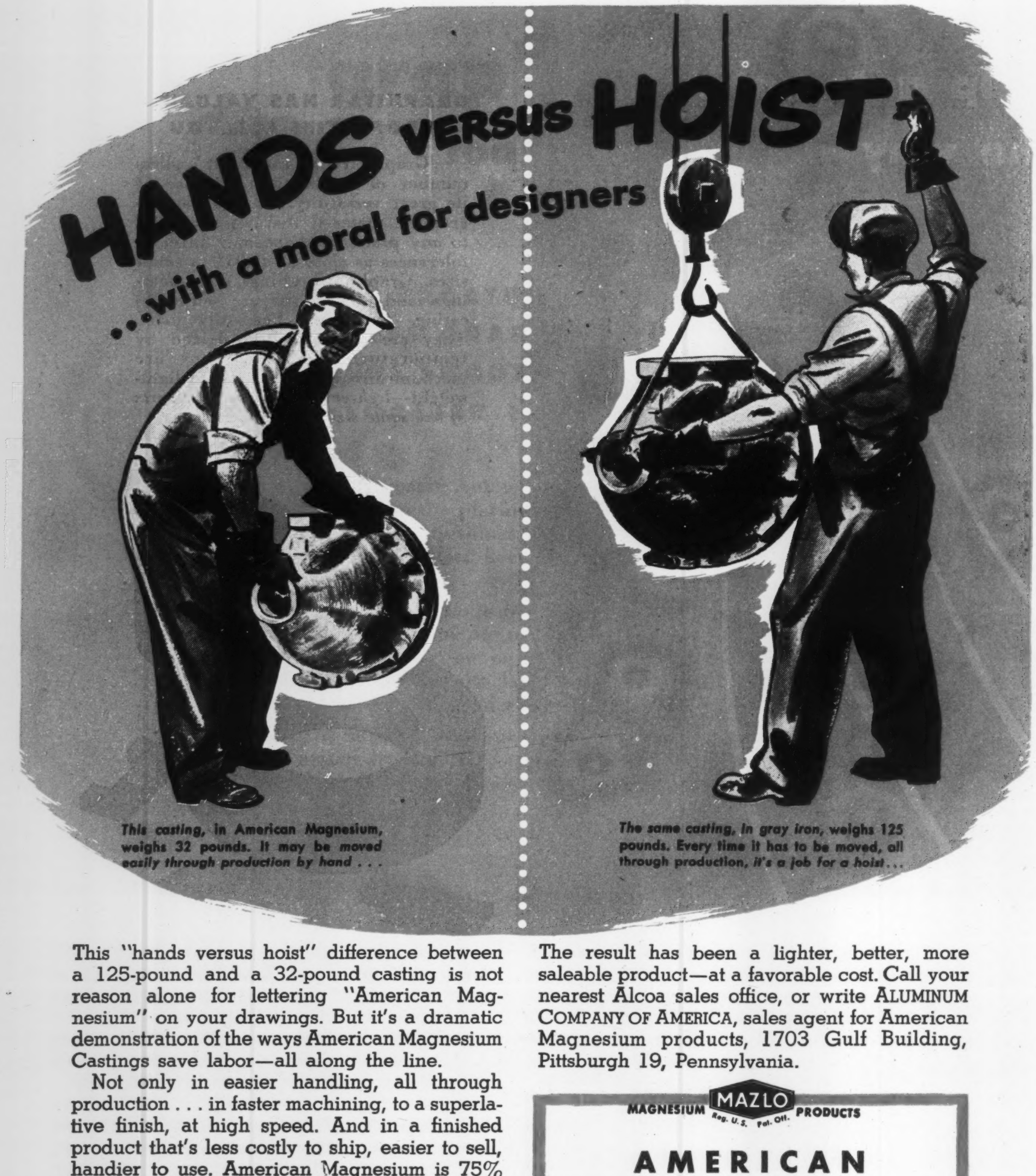
GRAPHITAR HAS VALUABLE PROPERTIES FOR YOU

Graphitar has an almost endless number of applications because of its great versatility. It is a carbon-graphite material that we *can mold to any practical shape* and finish to tolerances as close as .0005" in small sizes. Graphitar bushings, seals, bearings, and other parts are self-lubricating. They are chemically inert. They are practically unaffected by temperature extremes. They are mechanically strong. They are lightweight—*lighter than magnesium parts of the same size and form.*



graphitar
(CARBON-GRAPHITE)

COMPANY • SAGINAW, MICHIGAN


HANDS VERSUS HOIST
...with a moral for designers

This casting, in American Magnesium, weighs 32 pounds. It may be moved easily through production by hand . . .

The same casting, in gray iron, weighs 125 pounds. Every time it has to be moved, all through production, it's a job for a hoist . . .

This "hands versus hoist" difference between a 125-pound and a 32-pound casting is not reason alone for lettering "American Magnesium" on your drawings. But it's a dramatic demonstration of the ways American Magnesium Castings save labor—all along the line.

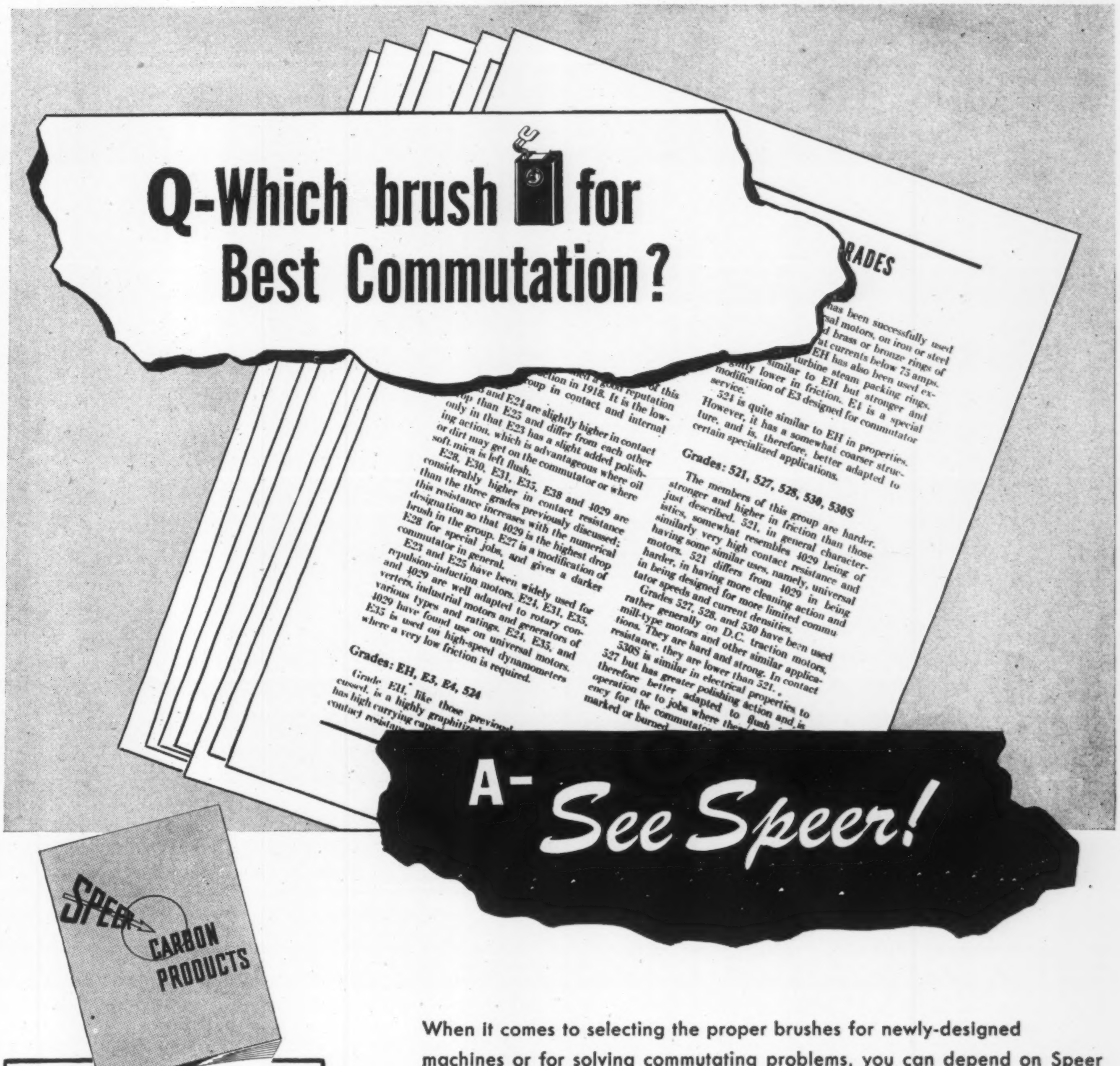
Not only in easier handling, all through production . . . in faster machining, to a superlative finish, at high speed. And in a finished product that's less costly to ship, easier to sell, handier to use. American Magnesium is 75% lighter than steel, 35% lighter than aluminum.

Many a designer who considered the application of magnesium to product or shop practices difficult, has learned otherwise with the help of Alcoa's 59 years of light-metal know-how. The result has been a lighter, better, more saleable product—at a favorable cost. Call your nearest Alcoa sales office, or write ALUMINUM COMPANY OF AMERICA, sales agent for American Magnesium products, 1703 Gulf Building, Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO PRODUCTS
Reg. U. S. Pat. Off.

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA


Q-Which brush for Best Commutation?
A- See Speer!
SPEER CARBON PRODUCTS

When it comes to selecting the proper brushes for newly-designed machines or for solving commutating problems, you can depend on Speer for sound practical advice.

Speer knows brushes — the operating conditions for which each grade is best suited. Speer also knows motor and generator characteristics. With this 50-year combination of experience, Speer is highly qualified in matching brushes to machinery, mechanically and electrically, to deliver peak commutating performance.

Here is a service you cannot afford to overlook. Why not take your brush problems to Speer?

MORE ANSWERS IN THIS BOOK. GET IT!

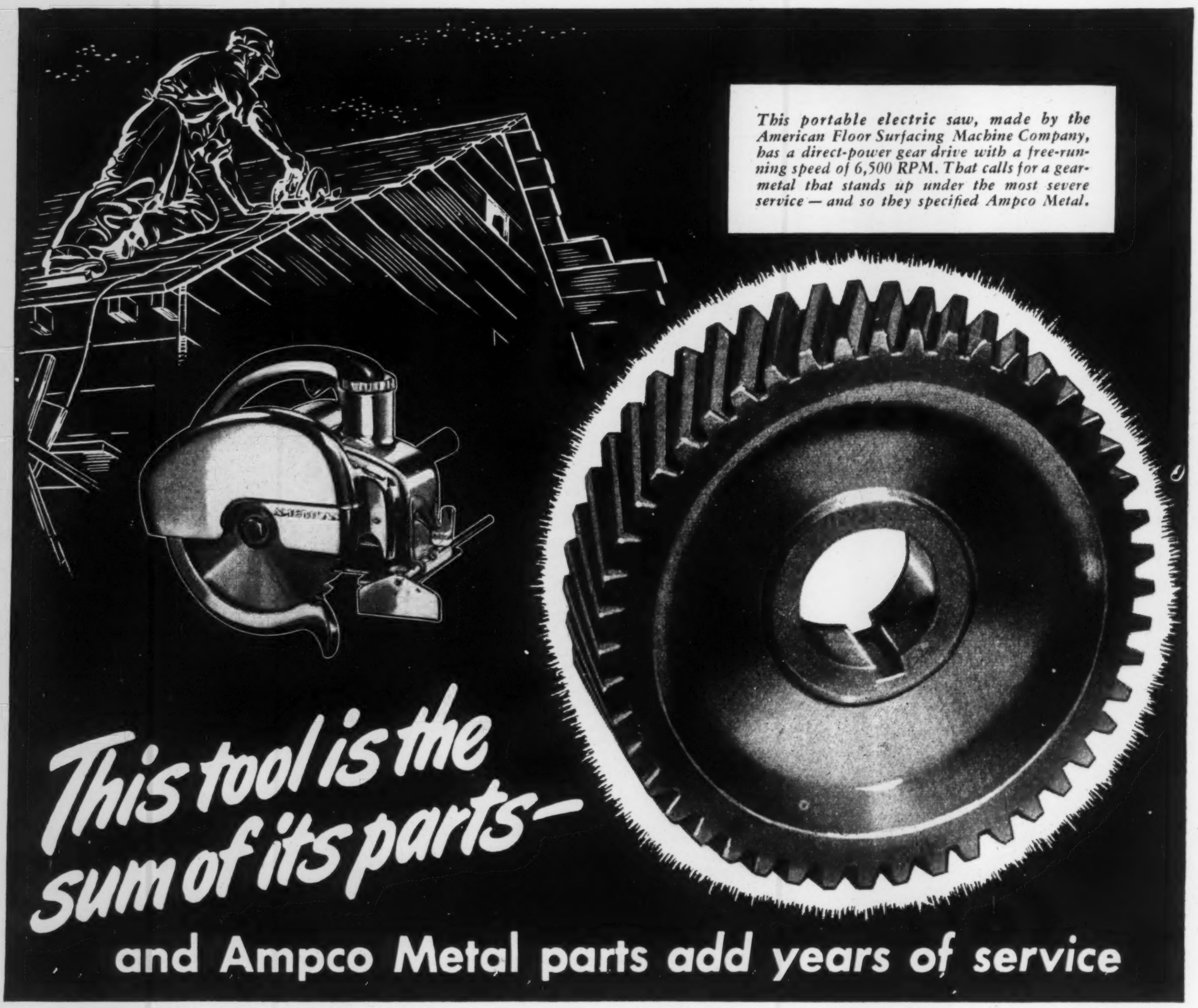
This catalog SPEER CARBON PRODUCTS gives detailed information on brush characteristics, includes Speer Brush Data Sheets. It answers your questions on brush selection, helps you find the right brush for your motors or generators.

SPEER
Speer
CARBON COMPANY
ST. MARYS, PENNA.

2528

brushes · contacts · welding electrodes · graphite anodes · rheostat discs · packing rings · carbon parts

CHICAGO · CLEVELAND · DETROIT · MILWAUKEE · NEW YORK · PITTSBURGH


This tool is the sum of its parts—
and Ampco Metal parts add years of service

This portable electric saw, made by the American Floor Surfacing Machine Company, has a direct-power gear drive with a free-running speed of 6,500 RPM. That calls for a gear-metal that stands up under the most severe service — and so they specified Ampco Metal.

Use Ampco extruded aluminum bronzes for three-fold production savings . . .

Nothing less than Ampco Metal is acceptable for this gear — in effect, that's what this company said in specifying that every part in their portable saw be "selected to assure long life, uninterrupted service, and customer satisfaction."

Their engineers selected Ampco Metal, the modern aluminum bronze, for the stamina, wear-resistance, and impact strength required in a direct-drive gear. Extensive tests proved their judgement and indicated that *a strong selling point had been added to their product* — long, dependable service.

Unusual wear-resistant qualities make Ampco Metal the ideal selection for parts that must be dependable under severe operating conditions. In extruded form, it also affords distinct production economies — controlled, dense structure reduces rejects caused by hidden flaws; size close to requirements reduces waste, machining time and cost.

Ampco Metal is produced also by centrifugal-, sand-casting, or forging according to your requirements. Let your nearby Ampco engineer help you select the proper grade for your needs, from the seven standard grades and several modifications available. For complete information on Ampco Metal products, write for Bulletin 71 today!

Ampco Metal has 7 outstanding performance advantages—

Excellent bearing qualities • High strength-weight ratio • High compressive strength • High impact and fatigue values • Corrosion resistance • Efficiency at extreme temperatures.

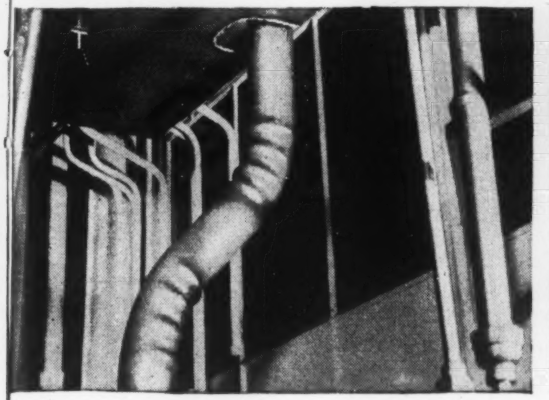
REG. U. S. PAT. OFF.

AMPCO

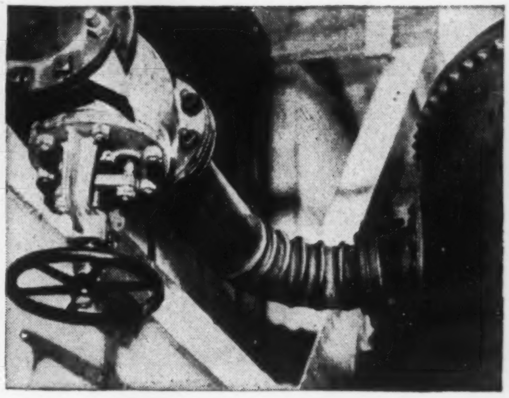
Ampco Metal, Inc.
Dept. MD-10 • Milwaukee 4, Wis.
Field Offices in Principal Cities

AD-31

"Tailor-Made" Bends

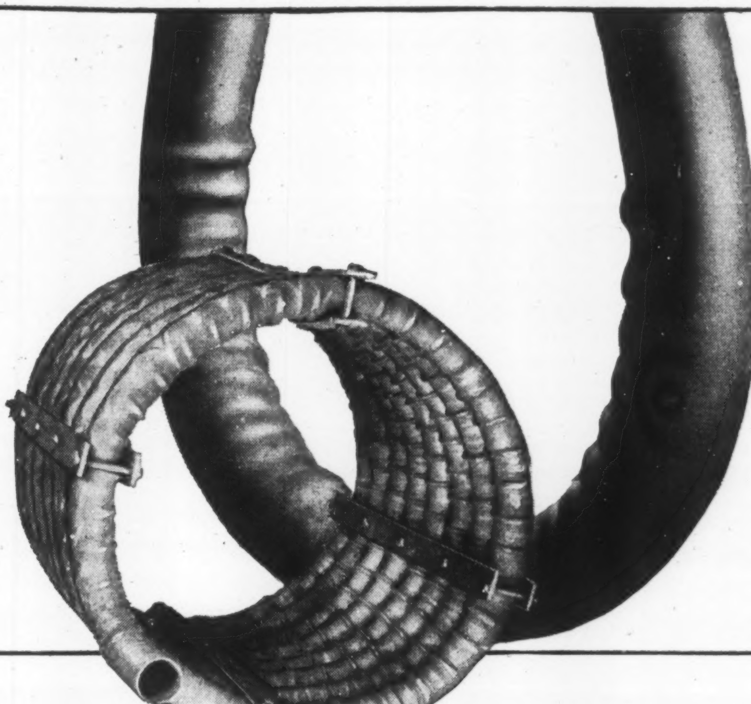


Where compound bends are required in a continuous section of pipe, wrinkle-bends offer an ideal solution. Wrinkle-bends are leakproof, as strong as the pipe itself, require no maintenance, and are easy to insulate.



This short-radius wrinkle-bend joins a compressed air line to a reservoir. Wrinkle-bends can be made in brass, copper, aluminum, and steel pipe from 2 inches to 26 inches in diameter.

Pipe bends can be made right on the spot with the aid of an oxy-acetylene welding or heating blowpipe, a simple bending rig, and a few common tools. Wrinkle-bending does not reduce the thickness of pipe walls.



This condenser coil made from 2-inch stainless steel pipe has 350 wrinkle-bends.

There are many LINDE methods for forming, cutting, joining, and treating metals. LINDE engineering service is always on call to help customers with production and maintenance jobs. Just call the nearest LINDE office.

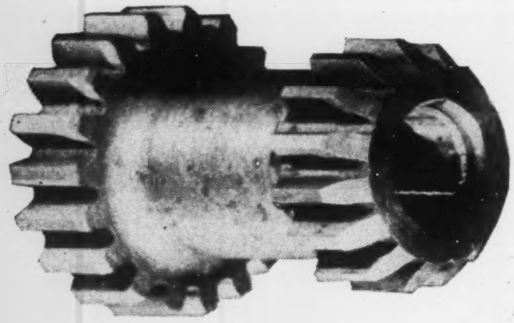
The word "Linde" is a registered trade-mark of The Linde Air Products Company.

See HELIARC and UNIONMELT
Welding Demonstrations
Area No. 838 & 840
National Metal Exposition
Chicago, October 18 to 24

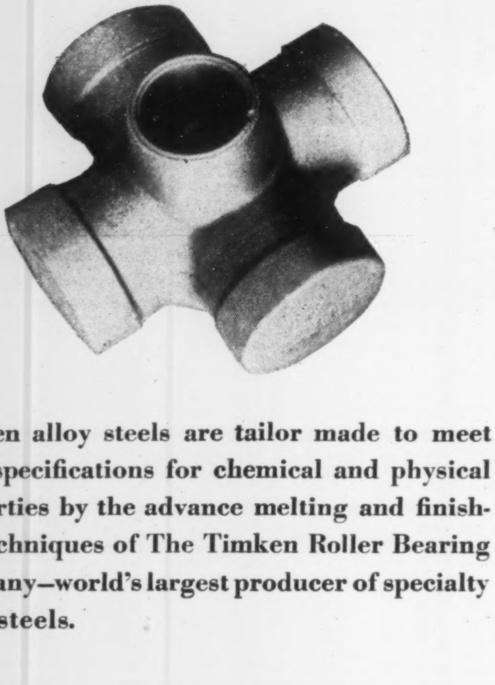
Linde

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

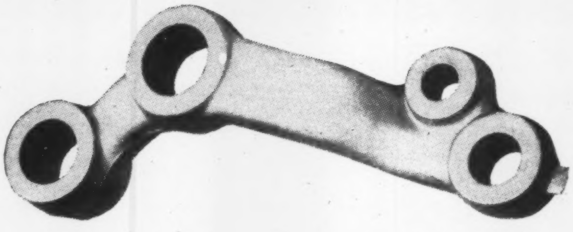
3 REASONS WHY TIMKEN ALLOY STEELS MAKE BETTER FORGINGS



1 Timken alloy steels have superior surface and internal quality. This, plus uniform forgeability, means better forgings at lower cost.



2 Timken alloy steels are tailor made to meet your specifications for chemical and physical properties by the advance melting and finishing techniques of The Timken Roller Bearing Company—world's largest producer of specialty alloy steels.



3 Uniformity in composition and response to heat treatment of Timken alloy steels assure satisfactory performance of the finished forgings.

For better, more uniform forgings at lower cost, use Timken alloy steels. Our Technical Staff will be glad to recommend the correct analysis for your requirements. Also write for our authoritative forging guide, "Evaluating the Forgeability of Steels". Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

TIMKEN
TRADE-MARK REG U S PAT OFF
Fine Alloy
STEEL
and Seamless Tubes

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.

ALSIMAG technical ceramic insulators
TRADE MARK

CUSTOM MADE FOR YOUR REQUIREMENTS

AlSiMag versatility is illustrated by these AlSiMag inserts for electronic tubes

The insulation requirements of electronic tubes vary with the function and design of the tube. Factors of primary importance are: Resistance to extreme heat shock without cracking and without reduction in strength; resistance to formation of electrical conduction paths; long life and strength even in tubes operated at relatively high temperatures. They must also be readily degassed and uniform in quality and dimension.

There is an AlSiMag technical ceramic composition with the physical characteristics suited to almost any electronic tube insulator or to any product requiring electrical insulation. That composition can be custom made in the size and shape which best meets your requirements. Most designs can be produced in quantities quickly and at low cost by die pressing. If you will send us your blue prints and technical data, we will be glad to outline the facts about AlSiMag Custom Made Technical Ceramics as they apply to your product.

46TH YEAR OF CERAMIC LEADERSHIP

AMERICAN LAVA CORPORATION

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SALES OFFICES: ST. LOUIS, MO., 1123 Washington Ave., Tel: Garfield 4959 • CAMBRIDGE, MASS., 38-B Brattle St., Tel: Kirkland 4498 • PHILADELPHIA, 1649 N. Broad St., Tel: Stevenson 4-2823 NEWARK, N. J., 671 Broad St., Tel: Mitchell 2-8159 • CHICAGO, 9 S. Clinton St., Tel: Central 1721 • SAN FRANCISCO, 163 2nd. St., Tel: Douglas 2464 • LOS ANGELES, 324 N. San Pedro St., Tel: Mutual 9076

Do You Need a High-Strength Alloy to Resist Corrosion?

One of these grades of HASTELLOY Alloy may be what you require

	HASTELLOY A	HASTELLOY B	HASTELLOY C	HASTELLOY D
Composition:	nickel-molybdenum-iron	nickel-molybdenum-iron	nickel-molybdenum-chromium-iron	nickel and silicon
Excellent Resistance To:	hydrochloric and sulphuric acid	boiling hydrochloric acid and wet hydrochloric acid gas	free chlorine, acid solutions of ferric and cupric salts, and sulphuric acid	sulphuric acid of all concentrations up to the boiling point
Good Resistance to:	phosphoric, acetic, formic, and other organic acids	sulphuric acid	hydrochloric and nitric acid	phosphoric acid
Available Forms:	castings, forgings hot-rolled bars, strip, plate, sheet, rods, wire, welded tubing	castings, forgings, hot-rolled bars, strip, plate sheet, rods, wire, welded tubing, cast or drawn welding rods	castings, plate, sheet, welded tubing, cast welding rods	castings, cast welding rods

Write us for samples and test them under your own operating conditions

Test coupons of these alloys are available without charge upon request . . . in sheet and cast form. In requesting samples, any information you can give us about the corrosive media, the type of equipment, or other conditions of service will help us choose the proper alloys to send to you.

HASTELLOY
TRADE-MARK

HAYNES STELLITE COMPANY
Unit of Union Carbide and Carbon Corporation
General Office and Works UCC Kokomo, Indiana
Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa

HIGH-STRENGTH NICKEL-BASE ALLOYS FOR CORROSION RESISTANCE

"Hastelloy" is a registered trade-mark of Haynes Stellite Company.

STAINLESS CROLOYS
B&W ALLOYS
SAE ALLOYS
NE ALLOYS
SPECIAL ANALYSES
CARBON STEELS
COLD DRAWN
HOT FINISHED
SEAMLESS
WELDED

MECHANICAL TUBING
seamless and welded
FOR ANY APPLICATION

. . . all from
ONE SOURCE

FINDING the right tubing—Seamless or Welded—for any mechanical application—is a simple problem when your requirements are put up to B&W. The variety of tubing made by B&W embraces the widest range of analyses available from one source. So no matter what kind you need—from plain carbon to high alloy tubes including a full range of ferritic and austenitic stainless steel grades—B&W makes it.

By centralizing your mechanical tubing requirements for all purposes at B&W, you simplify tube engineering and purchasing problems. In many cases, authorized distributors in all principal cities can fill your orders promptly from local warehouse stocks of dependable B&W tubes.

TA-1430M

Seamless and Welded Tubular Products in a full range of Carbon, Alloy, and Stainless Steels for All Pressure and Mechanical Applications.

★ ★ ★

Other B&W Products
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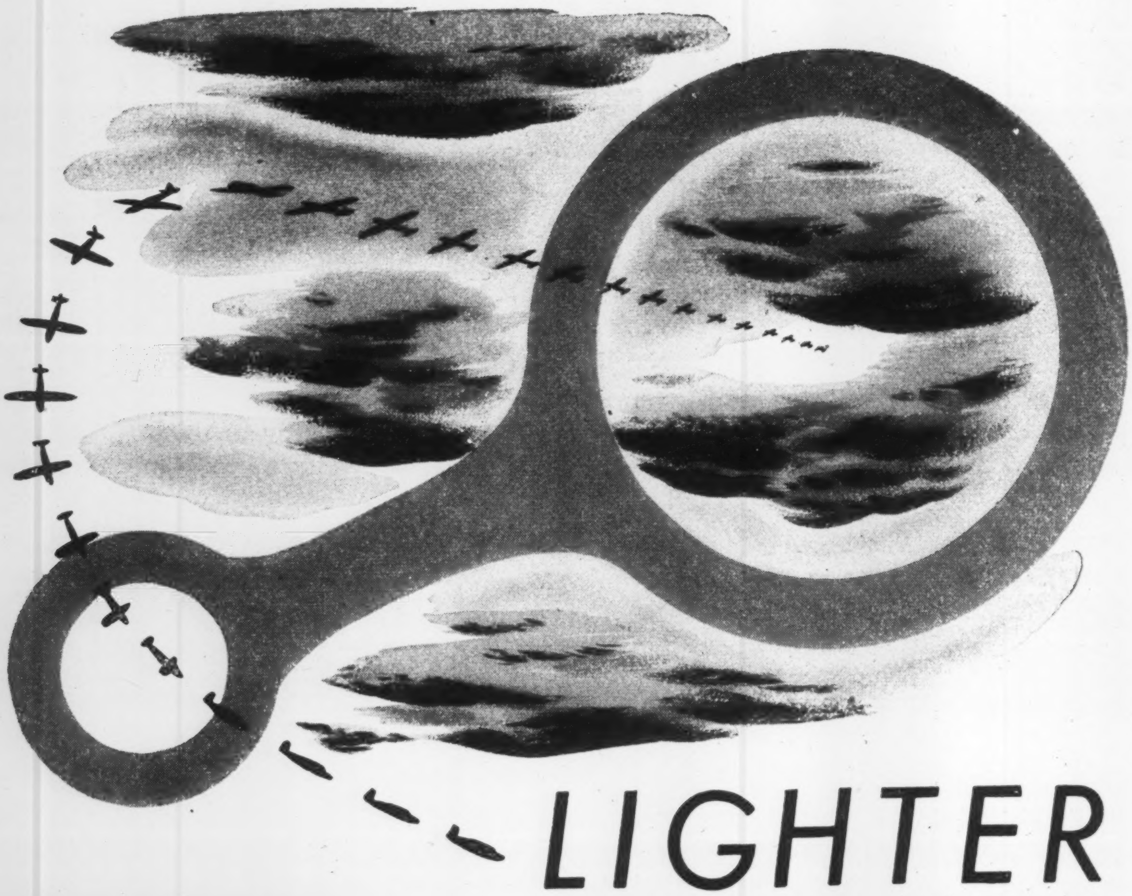
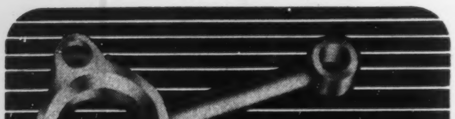
85 LIBERTY STREET · NEW YORK 6, N. Y.

Stationary and Marine Boilers . . . Boiler Components . . . Pulverizers . . . Fuel Burning Equipment . . . Refractories . . . Chemical Recovery Units . . . Process Equipment . . . Alloy Castings.

BABCOCK & WILCOX
SEAMLESS & WELDED TUBES
THE BABCOCK & WILCOX TUBE COMPANY
GENERAL OFFICES: BEAVER FALLS, PA.
PLANTS: BEAVER FALLS, PA. AND ALLIANCE, OHIO.



LIGHTER
YET STRONGER



"600" Bearing Alloy is approximately three times stronger than the best cast bearing bronze—**yet it contains no tin.** It develops a lower temperature under heavier loads and higher speeds than the bearing bronzes, and extreme pressure lubricants do not corrode it.

"600" Bearing Metal had hundreds of highly successful applications during the war in all branches of the service. Aviation engineers used "600" Bearing Metal for gears, light, high-speed connecting rods, and for many other purposes. It had many uses on equipment for desert warfare where sand penetrated into bearings and set up excessive abrasive action.

Primarily where a bearing is subjected to a reciprocating motion, reduction in weight is essential to keep vibration at a minimum and to assure maximum efficiency. Because "600" Metal is stronger per unit of weight, parts can be made of equal strength out of "600" Metal with a REDUCTION OF 10% TO 35% IN THE WEIGHT OF THE FINISHED PART.

Let us send you complete information. Please write us.

Specify 600 Metal!

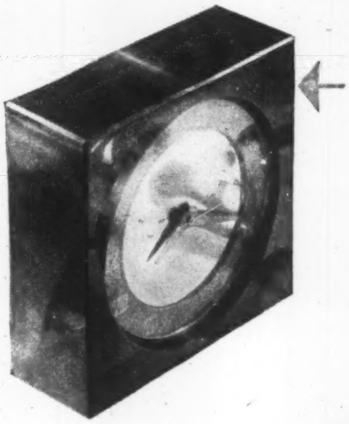
600
BEARING METAL

MUELLER BRASS CO.
PORT HURON, MICHIGAN

To help you select the right material for your product

Geon

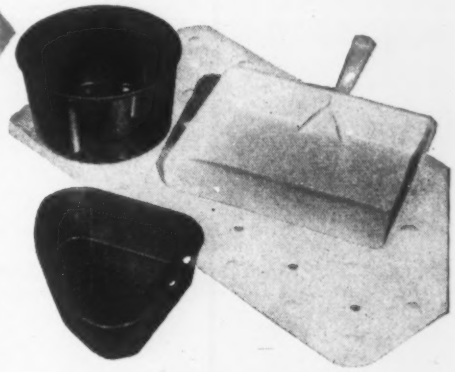
GEON is the name used to designate a group of thermoplastic resins which impart to finished products such properties as resistance to water, chemicals, abrasion, sun, mildew and most other normally destructive factors. GEON can be pressure or injection molded, extruded, calendered or cast into sheet or film. It is available in powder, paste-forming resin, polyblend (GEON-HYCAR) and latex forms. Products made from GEON may be brilliantly or delicately colored. The suitcase shown here is an example of a product made from calendered sheet.



KRISTON

KRISTON designates a group of thermosetting resins with many unusual properties. Products made from KRISTON may have excellent optical properties, unusually good electrical properties plus resistance to most normally destructive factors. As the clock at the left shows, products made from KRISTON can be most decorative in this and other forms such as jewelry, buckles, buttons, frames, desk sets, coasters, ash trays and many others. KRISTON is a relatively new product, and we invite suggestions and inquiries as to possible applications.

Hycar



HYCAR is the name applied to a group of American rubbers that have found wide usage in both consumer and industrial products. Typical are the household items shown at right which, like other products made from HYCAR, resist water, grease and oil, heat, aging, abrasion and many other destructive factors. HYCAR OR-15 is exceptionally oil resistant, and is an important material in the oil fields as well as in general industry. HYCAR and GEON may be blended for certain uses to impart to finished products the most favorable properties of each. (Products courtesy of Wooster Rubber Co., Wooster, Ohio.)

Good-rite
RUBBER CHEMICALS
AGRICULTURAL CHEMICALS
INTERMEDIATE ORGANIC CHEMICALS
B. F. Goodrich Chemical Company
ROSE BUILDING
CLEVELAND 15, OHIO

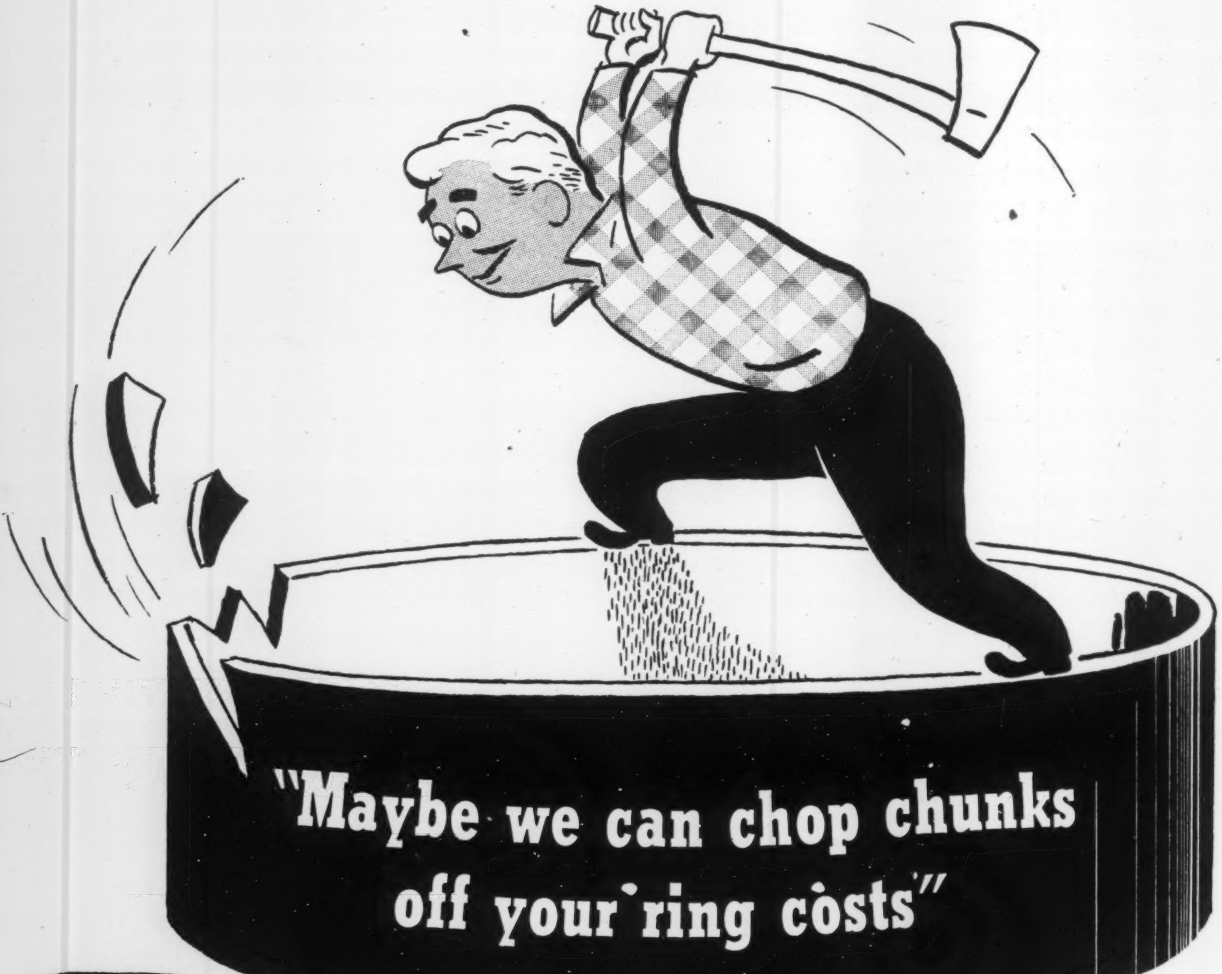
Good-rite

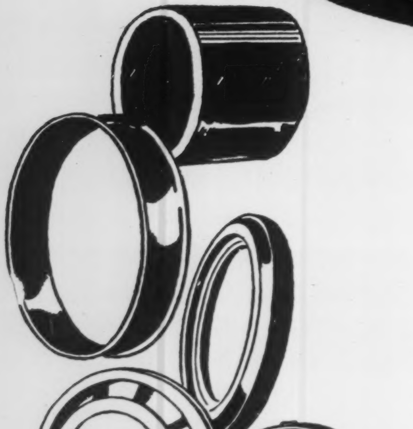
GOOD-RITE is the brand name of a constantly growing group of widely diversified chemicals. GOOD-RITE Erie, for example, is one of several outstanding chemicals for the rubber industry. GOOD-RITE p.e.p.s. is a new fungicide that promises great things for the future in agriculture. And there is a large group of intermediate organic chemicals which are finding new uses daily. The GOOD-RITE name is growing, and is certain to become an important one in many different industries.

We make no finished products from any of these raw materials. But we will be glad to work with you on any special problems or applications. For more information, or for an informative glossary of technical terms used in the Plastics and Rubber Industries, please write Department HN-10, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals are registered trade marks


"Maybe we can chop chunks off your ring costs"



Instead of painfully shaving your costs for circular shapes (rings, hoops, bands, etc.) why not chop off chunks? Many times sizable cost reductions are possible in quantity lots by using Cleve-Weld rolled and welded circles, made from strip, bar, plate or rolled mill shapes. By this method of forming, you buy less weight in metal, reduce scrap losses, get greater machinability with less total machining time and gain from a uniform grain structure.

Special rolling and welding equipment, automatically controlled, team-up with Cleve-Weld's 30 years of experience in welding circular shapes at rock-bottom costs.

If you use production quantities of circular shapes, investigate this possibility of lower costs. Send details, quantities required, and blue-print (if available) and let us quote; no obligation of course, so why not write today?

SEND US DETAILS AND LET US QUOTE

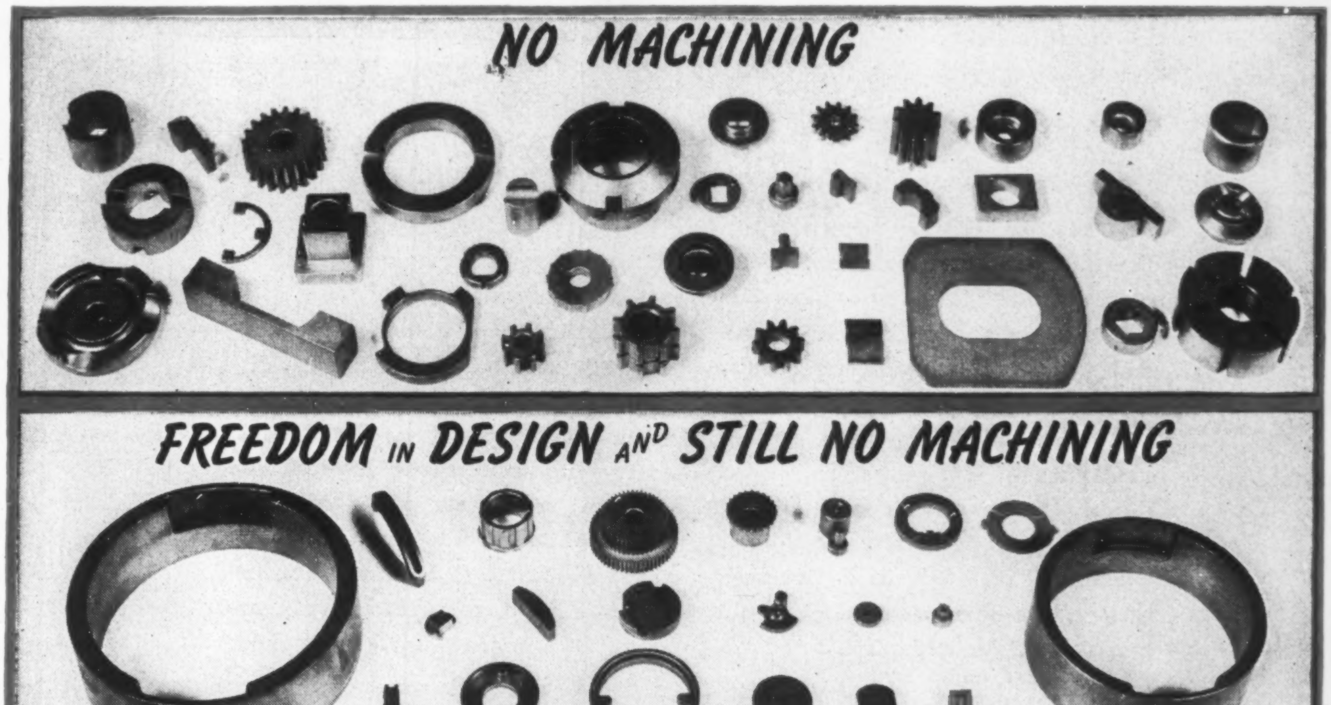
The CLEVELAND WELDING COMPANY

WEST 117th STREET & BEREA ROAD • CLEVELAND 7, OHIO

NOW OILITE

FINISHED-PRECISION

Machine PARTS


NO MACHINING

FREEDOM IN DESIGN AND STILL NO MACHINING

YOUR ADVANTAGES INCLUDE . . .

No TOOL UP!
Quick DELIVERY!
No MATERIAL Problem! *(Especially Iron)*
Quantity Production!
Special Properties!
SELF-LUBRICATING SURFACE! *(If Desired)*
Lower Cost!

FERROUS and NON-FERROUS MATERIALS

EXPERIENCED STAFF of FIELD and FACTORY ENGINEERS at YOUR SERVICE

CHRYSLER CORPORATION

AMPLEX DIVISION—DETROIT 31, MICHIGAN

Rigidized

REGISTERED U. S. PATENT OFFICE

design-strengthened, textured **Metals**

give your products *Beauty*

that is more than skin deep!

The Rigidizing process increases the strength and rigidity values of ferrous and non-ferrous metals—at the same time providing beautiful, decorative surface textures.

Rigidized Metals provide greater strength with less weight, increased rigidity, better resistance to impact, and buckling. They offer the greater eye-appeal of a beautifully textured surface that minimizes scratches, fingerprints, glaring highlights and annoying reflections. Wherever sheet or strip metals are used, Rigidized Metals can be applied. They can be punched, stamped, bent, formed and fabricated by methods ordinarily used for the materials involved. Perforated Rigidized Metals make excellent grilles or screens.

Rigidizing is a patented process, whereby the metal is scientifically redistributed throughout the cross-section and away from the neutral axis. Rigidizing gives higher mechanical values per pound of metal and imparts the selected texture design. Widths up to 36 inches can be provided, and metal thicknesses are from .005 inches to .125 inches. The advantages of Rigidized Metals are frequently secured at no greater cost than other finishes.

We will gladly furnish detailed information on the process and offer suggestions for its use in your products.

Covered by U.S. and Foreign Patents

RIGID-TEX CORPORATION
Buffalo 3, New York

Offices in Principal Cities

Write
for technical data, information on patterns and applications.

Please attach coupon to your company letterhead.

RIGID-TEX CORPORATION
Buffalo 3, New York

Will you please send data on Rigidized Metal? I have in mind the following application_______________

____

Name_______________ Title__________

Company_________________________

Address_________________________ MD

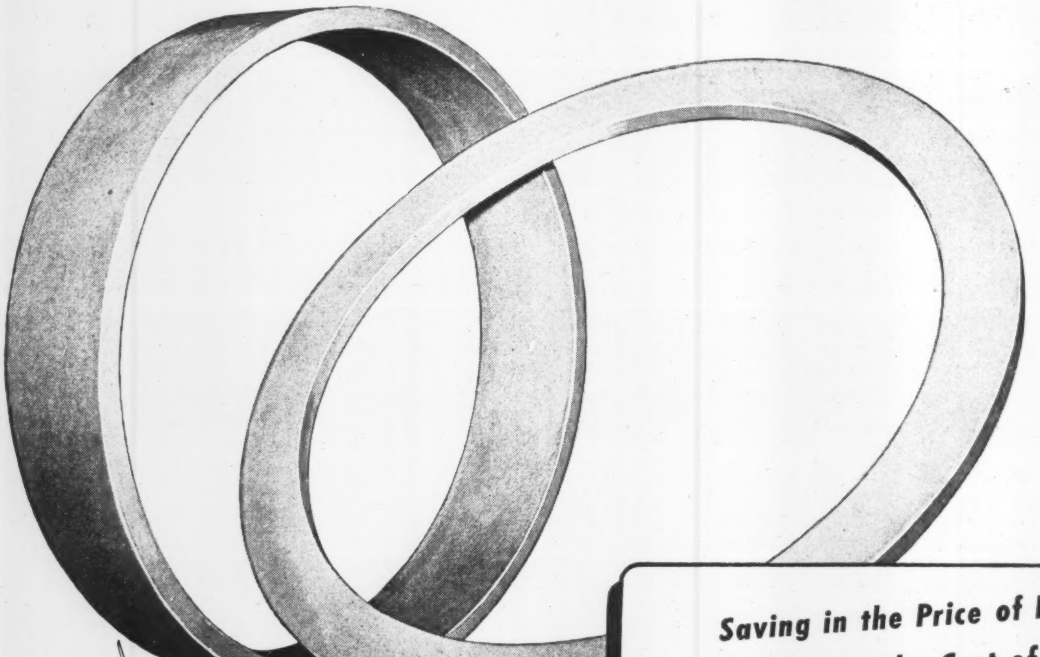
STAINLESS STEEL RINGS
by AMERICAN WELDING

Compared with any other manufacturing method, *welded* stainless steel rings prove to be equally efficient and much less expensive. Records show that there is a substantial

SAVING IN THE PRICE OF RINGS
SAVING IN THE COST OF TOOLING

when stainless rings are produced by the welding process.

If you use stainless rings, or any other welded product, a few moments spent with our representative may prove to be very advantageous. May we hear from you?



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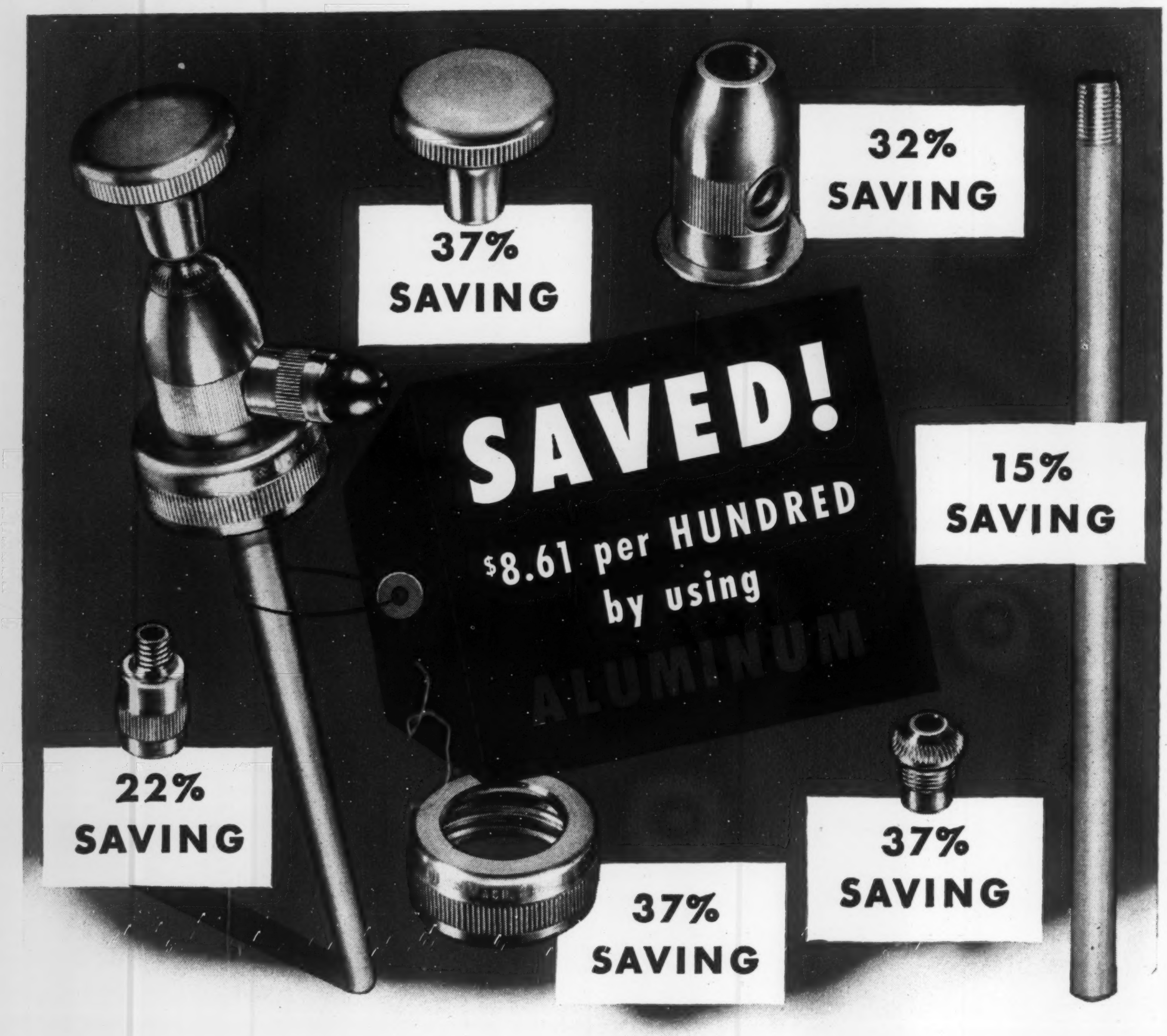
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Before he switched to Alcoa Aluminum 11S-T3 Screw Machine Stock for most of the parts of this insecticide spray gun, the manufacturer had made the gun almost entirely of brass.

The tag on each of the aluminum screw machine parts shows the total saving on that part by switching from brass and cadmium plated steel to Alcoa Aluminum. He uses Alcoa 11S-T3, the screw machine alloy that will permit you to make similar savings.

Note the savings on parts. Then let us give you further information on Alcoa 11S-T3. Write to ALUMINUM COMPANY OF AMERICA, 1940 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in leading cities.

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Directory of Materials

Fourteenth Edition

Progress in design often is dependent upon and, indeed, sometimes awaits progress in the development of new or improved materials. In recognition of the close interdependence of design and materials, MACHINE DESIGN presents herewith the Fourteenth Edition of its Directory of Materials.

To facilitate quick spotting of materials this directory has been completely revised and now contains only three major listings. The first listing presents materials by trade names in alphabetical order and includes brief data on properties, characteristics and representative machine applications. The second, an index by types, is particularly useful for finding and comparing similar materials, or for selection based on alloy constituency. Lastly, the alphabetical listing of producers of materials gives complete addresses along with trade names and types of materials each company produces.

Inasmuch as the standard AISI grades of wrought stainless steels are produced under a variety of trade names by a number of producers, a single listing—"Stainless Steels"—immediately following the list of materials by trade names, presents brief data on properties, characteristics, uses and forms, and is accompanied by a list of producers, types of stainless produced and their trade names.

Many new types of metals, plastics and nonmetallics are included in the current directory. In addition, listings from previous issues have been revised to bring them up to date. Every attempt has been made to make this edition a thoroughly reliable reference for the designer in his selection of modern materials.

Contents

Materials Listed by Trade Names 181

Includes materials types and analyses, plus brief data on properties, characteristics and representative machine applications. Also lists names of producing companies.

Stainless Steels 229

Lists standard AISI types along with analyses, properties, characteristics, representative machine applications, and a list of trade names plus names of producing companies and addresses.

Index of Materials by Type 231

Cross index for comparing similar materials and for selection based on major alloy constituents.

Materials Producers 235

Names and complete addresses of producers along with types and trade names of materials produced.

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Additional copies of this directory are available at one dollar each. Orders should be sent to Readers Service Department, MACHINE DESIGN, Penton Bldg., Cleveland 13, O., and a 3% state tax included for orders originating in Ohio.

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Materials Listed by Trade Names*

(For listing by producing companies, and complete street addresses, see Page 235).
For index of materials by type, see Page 231)

A

ABK METAL (Alloy steel castings)—Brake Shoe & Castings Div., American Brake Shoe Co., New York.

Ni-Cr alloy steel furnished as sand castings to specification. Ts, 55-80,000 psi; elong in 2 in., less than 0.05 per cent; Bhn, 550-750; magnetic; weldability, poor; abrasion resistance, very high. Used where castings are subject to severe abrasion and where intricate machining and high impact are not encountered.

ABRASOWELD (Welding electrode) — Lincoln Electric Co., Cleveland.

Arc-welding electrode for providing abrasion-resisting, self-hardening deposit which hardens rapidly under impact and abrasion; maximum hardness develops at surface, leaving cushion of softer metal beneath. Provides resistance to abrasion in straight carbon, low-alloy or high-manganese steel surfaces; effective on gear and pinion teeth.

ACADIA (Synthetic rubbers)—Acadia Synthetic Products Division of Western Felt Works, Chicago.

Synthetic rubber compounds to meet Army, Navy and AMS specifications in sheets, extrusions and molded parts.

ACCOLOY (Stainless steel castings)—Alloy Castings Co., Champaign, Ill.

Analysis ranges from 18 per cent chromium, 8 per cent nickel to 68 per cent nickel and 18 per cent chromium. Furnished in castings. It is nonmagnetic, and heat resistant to 2300 F. Weldability, good; abrasion resistance, low. Used for corrosion-resistant applications such as pump parts, tubing, chemical processing furnaces, etc., where resistance to corrosion and/or temperature is required.

ACE (Hard rubber)—American Hard Rubber Co., New York.

Hard rubber; thermosetting; furnished in sheets, rods or tubes and molded parts; may be machined, molded or extruded into parts; moisture absorption, low; abrasion resistance, medium; chemical resistance, excellent in most acids, alkalies and salt solutions; attacked by strong oxidizing solutions; flexibility, medium; ts, 5-9000 psi; comp str, 12.000 psi; dielectric str, 475 volts per mil; flexural str, 15,000 psi; elongation, 3-6 per cent; color range limited; high shock resistance; opaque; sp gr, 1.18-1.2; rockwell HR 95.

Heat-resistant hard rubber; furnished in sheets, rods or tubes and molded parts, for molding, extruding and machining; abrasion resistance, medium; chemical resistance, excellent in most acids, alkalies and salt solutions; attacked by strong oxidizing solutions; flexibility, low; dielectric str, 400 volts per mil; ts, 5-6500 psi; comp str, 10,000 psi; flexural str, 8-10,000 psi; elongation, 1-3 per cent; moisture absorption, low; color range limited; opaque; sp gr, 1.65-1.8; medium shock resistance; machinability, fair. Both used for handles, caster wheels and special molded parts.

ACIPCO (Cast irons and steels)—American Cast Iron Pipe Co., Birmingham, Ala.

Sand castings and permanent-mold castings of plain cast iron, alloy cast iron, Ni-resist, Ni-hard, plain carbon steels, and all grades of alloy steels including stainless.

ACME STRIP (Strip Steel)—Acme Steel Co., Chicago 8, Ill.

Hot and cold-rolled strip steel; furnished in sheets and strips (coiled) for stamping into parts. Material is furnished to specification and is available in most sizes from ¼ to 22 in. in width and in thicknesses ¼-inch and less.

ACORN (Babbitt metal)—A. W. Cadman Mfg. Co., Pittsburgh.

Babbitt metal furnished in ingots; Bhn, at 70 F, 23.8; at 212 F, 21.8; comp str, 12,500 psi. For bearings having reciprocating motion, subject to excessive pounding or vibration.

ADAMANTINE (Special cast steel)—The Babcock & Wilcox Co., New York 6, N. Y.

Special wear resistant steel castings. Machinable. For grinding mills, mixers, conveyors, power shovels, etc.

ADAMANT SUPER-GENUINE (Babbitt)—Magnolia Metal Co., Elizabeth, N. J.

Over 90 per cent tin, free of lead, containing special fluxes; furnished as ingots; sp gr, 7.34; bearing properties, good; Bhn, untreated, 23. Used for bearings, diesel engines, connecting rods, etc., subject to shock or strain.

ADMIRALTY Metal (Cu-Zn-Sn Alloy)—Revere Copper & Brass Inc., New York 17.

Cu 71, Zn 28, Sn 1, and As 0.05; furnished in straight and coiled strip, tubing, sheet and plate; for machining, cold working, arc and gas welding. In cold-worked state; ts, 85,000 psi; ys, 70,000 psi; elong in 2 in., 5 per cent; hardness, 90 Rockwell B; sp gr, 8.53; weldability, good; resists corrosion caused by saline waters; max cont serv temp, 500 F. For condenser tubes, plates, baffles, steampower plant equipment and chemical and processing equipment parts.

ADNIC (Copper-nickel alloy)—Scovill Mfg. Co., Waterbury, Conn.

Patented alloy of the copper-nickel group containing a controlled tin content of one per cent; Ni 29-32, Sn 0.75-1.25, Cu remainder; available in strip. Has excellent corrosion resistance characteristics against many dilute minerals and organic acids, alkalies and salt solutions. Ts, 90,000 psi (hard); density 0.322 lbs. cu in.; recommended annealing temperature range, 1200-1500 F (650-625 C).

ADVANCE (High copper-nickel alloy)—Driver-Harris Co., Harrison, N. J.

Cu 55, Ni 45; thermocouple material. For applications where low-temperature coefficient of resistivity is required; such as in measuring instruments, industrial and radio rheostats and elevator controls.

AERISWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

Arc-welding electrode; for welding of bronze, brass and copper, either in manufacturing or maintenance work.

AEROLITE (Shatterproof laminated window glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Laminated thin, window glass with vinyl plastics binder, furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat resistant to 160 F; flexibility, low; moisture absorption, low; nonflammable; shatterproof; transparent; highly polished. For windows where low weight is important.

AERTITE (Rubbery asphaltic asbestos material)—Johns-Manville, New York 16.

Furnished in soft plastic form. Used on mechanical equipment to prevent air infiltration.

AETERNA 600 (Copper-zinc alloy) — Mueller Brass Co., Port Huron, Mich.

Cu 60, Zn 38 and balance of Mn, Si and Al. Furnished in finished rods or bars, tubing, and in forgings, for extruding and hot forgings. Ts, 85-90,000 psi; nonmagnetic; weldability, good; abrasion resistance, low. For bearings, gears, cams, levers, etc.

AFIRON (Gray iron)—Terre Haute Malleable & Mfg. Corp., Terre Haute, Ind.

Produced in sand castings to suit specifications; in untreated state, ts, 30-60.000 psi; Bhn, 207-260; is magnetic; weldability, good when preheated at 700 F.

AGALOY (Tubing)—Agaloy Tubing Co., Springfield, O.

Welded, spiral-brazed and seamless tubing of carbon steels SAE 1010 to 1095, alloy steels SAE 4130 to 4150, SAE 6115 to 6195, and SAE 52100.

Cold-drawn welded tubing of stainless steels AISI types 304, 316, 317, 321, 329, 347 and 430. Cold-drawn seamless tubing of stainless steels AISI types 304, 308, 316, 317, 321, 347, 410, 430 and 446. For property and application data, see "Stainless Steels" listing at end of this section.

Monel, Inconel and nickel tubing for applications requiring high resistance to corrosion, oxidation and scaling, combined with good strength at high temperatures, good ductility and impact strength at low temperatures.

Composite tubing made up of two or more different metals to specification.

AGILE (Arc welding electrodes) — American Agile Corporation, Cleveland 3, Ohio.

Red-white electrode; mild steel; furnished in rods; used for welding mild steel and low alloy steel in single or multiple pass fillet production and fabrication welding, even on poorly fit-up assemblies. Ts, 70,000 psi; ys, 60,000 psi; Bhn, 160. Meets AWS classification E-6012.

Blue-red electrode; mild steel; furnished in rods; for joining mild steel and low alloy steel. Ts, 70,000 psi; ys, 60,000 psi; Bhn, 165. An all-position ac electrode recommended primarily for low open-circuit voltage transformers, as well as for general ac fabrication welding. Meets AWS classification E-6013.

Blue-gray electrode; mild steel; furnished in rods; for joining mild steel, low alloy steels, cold rolled and medium carbon steels. Ts, 60,000 psi; ys, 60,000 psi; Bhn, 160. A semi-automatic (drag-type) electrode, furnishing high-quality, x-ray dense, weld metal of excellent appearance, meeting AWS classification E-6020.

***The manner in which the trade names and trade marks are set up or catalogued in this directory shall not be construed as denoting them generic or free for general use.**

Hardface electrode; three different carbon-chromium-molybdenum alloy steels, composition depending on final hardness desired. Furnished in rods; Bhn range, 250-600. For rebuilding machine surfaces exposed to wear, impact, slight corrosion, and requiring various degrees of hardness.

Toughface; a heavy coated manganese nickel electrode; furnished in rods; Bhn ranges from 200-500. The weld deposit work hardens rapidly and is extremely resistant to impact and abrasive wear. Used for refacing of crushing and grinding equipment, railroad frogs, switches, etc.

Yellow-M; a heavily coated copper-nickel alloy; furnished in rods; for joining cast iron; Bhn, 160. For repairing and refacing cast iron machine parts, where machining after welding is required.

Yellow-Ni; a heavily coated nickel-core electrode; furnished in rods; for welding cast iron; Bhn, 160. For repairing and reclaiming of cast iron machine parts, where ductile welds that are machinable after welding are required.

Bronze electrode; a heavily coated phosphor bronze core electrode; furnished in rods; for joining brass, bronze and other copper-base alloys. Also for joining steel and cast iron to bronze and for reclaiming cast iron parts.

Aluminum electrode; of pure aluminum or aluminum plus 5% silicon alloys, flux coated. Furnished in rod form; for welding commercially pure aluminum or other aluminum-base alloys.

Silver-green; alloy steel; furnished in rods; hardness, Rockwell C 45-59. For repair and rebuilding of cutting edges exposed to impact and wear. For example, chisels, stamping dies, perforating dies, punches, etc.

Silver-blue; alloy steel; furnished in rods; hardness, Rockwell C, 48-54. For repair of cold working dies, broaches, gages. Weld metal is nondeforming upon heat-treatment.

Silver-red; alloy steel; furnished in rods; hardness, Rockwell C, 62-64. For building up high speed cutting edges on tools such as planer and milling tools, high speed drills, lathe centers, etc.

AGRICOLA (Bearing bronze)—Saginaw Bearing Co., Saginaw, Mich.

Cu 70, Pb 30; impurities less than 0.2 of 1; resists corrosion caused by acids; resists heat to 500 F; ductility, medium. Especially adapted to diesel and airplane engine bearings.

AJAX (High-carbon tool steel)—Kidd Drawn Steel Co., West Aliquippa, Pa.

Open hearth and electric furnace tool steels: Open hearth, C 1.00-1.20, Mn 0.30-0.50, P 0.04 max, S 0.045 max, Si 0.15-0.25. Electric furnace, the same analysis with the exception of C 1.00-1.10, and Mn 0.40 max. Furnished in finished bars or rods and wire. Slow heating treatment, 1425-1550 F; drawing temperatures depending upon size of section and hardness required. Bhn (as drawn), 197-207. For drills, taps, threading dies, etc.

AJAX (Rubber)—Hewitt Rubber Div., Hewitt-Robins Inc., Buffalo 5.

Rubber for hose, belting and packing. Can be furnished extruded or for molding. Abrasion resistance, high. For use wherever hose, belting or packing are required.

AJAX (Hard rubber)—Vulcanized Rubber & Plastics Co., Morrisville, Bucks County, Pa.

Furnished in sheet, strip, rod and tubes. Abrasion resistance, high; max cont serv temp, 140 F; is slow burning; flexibility, high; dielectric strength (volts per mil inst.), 470; ts, 7000-9500 psi; flexural strength, 10,000-15,000 psi; elong, 3.5-6.0%; moisture absorption, nil; produced in black, brown and mottled; sp gr, 1.17-1.19; is opaque; machinability, excellent; hardness, Rockwell HR 90-105.

ALCLAD (Clad aluminum)—Aluminum Co. of America, Pittsburgh.

14S; same as Alcoa 14S composition sheet, plate; ts, 59-65,000 psi. For general structural applications where high resistance to corrosion and high strength are required.

24S; same as Alcoa 24S composition; sheet and plate; same strength as ALCOA 24S. For structural construction in aircraft.

75S; composition same as Alcoa 75S; sheet and plate; ts, 76,000 psi. For structural uses in aircraft; strong aluminum alloy.

3S; same as Alcoa 3S composition; tubing; ts, 15-28,000 psi. For handling liquids where corrosion is a problem.

ALCOA (Aluminum alloys)—Aluminum Co. of America, Pittsburgh.

2S; commercially pure aluminum sheet and plate, rod, bar, wire, rivets and press forgings. Ts, 13-24,000 psi. For sheet-metal work, chemical equipment and chemical conductors.

3S; Mn 1.2; in sheet and plate, extruded shapes, tubing, rod, bar and wire; ts, 16-29,000 psi. For sheet-metal work and gasoline tanks for aircraft and chemical equipment.

4S; Mn 1.2, Mg 1.0; tubing; ts, 26-40,000 psi; for high pressure gas and oil lines in automotive field.

11S; Cu 5.5, Pb 0.5, Bi 0.5; wire, rod and bar, screw machine products; ts, 53-57,000 psi.

14S; Cu 4.4, Si 0.8, Mn 0.8, Mg 0.4; heat-treatable forgings, extruded and rolled shapes; ts, 60-70,000 psi. For heavy-duty forgings, power shovel bails, airplane fittings, etc.

17S; Cu 4, Mn 0.5, Mg 0.5; furnished in rod and bar, wire, rivets forgings and screw machine products; ts, 62,000 psi. For structural applications in transportation fields.

A17S; Cu 2.5, Mg 0.3; rivets; ts, 43,000 psi. For aircraft; rivets can be driven in fully heat-treated condition.

18S; Cu 4, Mg 0.5, Ni 2; heat-treatable forgings; ts, 63,000 psi. Used for forged aircraft engine pistons where good strength at elevated temperatures is required.

24S; Cu 4.5, Mn 0.6, Mg 1.5; sheet and plate, rod and bar, wire, tubing, extruded shapes, rivets; ts 68-73,000 psi. For structural construction in aircraft.

25S; Cu 4.5, Si 0.8, Mn 0.8; forgings for airplane propellers; ts, 57,000 psi.

32 S; Cu 0.9, Si 12.5, Mg 1, Ni 0.9; heat-treatable forgings for pistons, low coefficient of expansion; ts, 56,000 psi.

A51S; Si 1, Mg 0.6, Cr 0.25; heat-treatable forgings for machine and automotive parts, especially for intricate forgings; ts, 47,000.

52S; Mg 2.5, Cr 0.25; furnished in sheet and plate, tubing, rod, bar and wire; marine and transportation applications; ts, 29-41,000.

53S; Si 0.7, Mg 1.3, Cr 0.25; furnished in wire, rolled and extruded shapes, rivets, screw machine parts and forgings; ts, 33-39.000 psi. For structures subject to severely corrosive conditions in naval and industrial applications.

56S; Mg 5.2, Mn 0.1, Cr 0.1; wire and rivets; ts, 42-58,000 psi. For joining magnesium and for cable sheathing.

61S; Cu 0.25, Si 0.6, Mg 1, Cr 0.25; ts, 35-45,000 psi; in sheet and plate, tubing, rolled and extruded shapes, wire, rod and bar. For applications in shipbuilding and transportation fields.

63S; Mg 0.65, Si 0.4; extruded shapes, extruded tubing; ts, 22-35,000 psi; for architectural applications, particularly when a pleasing anodic coating is desired.

75S; Cu 1.6, Mn 0.2, Mg 2.5, Zn 5.6, Cr 0.3; sheet, plate, rod, bar, wire and extruded shapes; ts, 88,000 psi. For structural applications in aircraft.

13; Si 12; ts, 37,000 psi; a general-purpose die casting alloy for large, intricate parts.

43; Si 5; ts, 19-30,000 psi; available as sand, permanent mold, and die castings. For castings that must be leakproof under pressure such as sewage disposal plant and pipe fittings.

85; Cu 4, Si 5; ts, 40,000 psi. General-purpose die casting alloy for brackets, frames and levers with thick sections.

108; Cu 4, Si 3; furnished as sand castings for manifolds, valves and other intricate castings requiring pressure tightness; ts, 21,000 psi.

A108; Cu 4.5, Si 5.5; furnished as permanent-mold castings for general-purpose castings of intricate design; ts, 28,000 psi.

C113; Cu 7, Si 3.5; permanent mold castings for automotive-engine cylinder heads; ts, 30,000 psi.

122; Cu 10, Mg 0.2; sand and permanent-mold castings for automotive pistons, camshaft bearings, valve tappet guides; ts, 27-40,000 psi.

A132; Cu 0.8, Si 12, Mg 1, Ni 2.5; permanent-mold castings for pistons; ts, 36-47,000 psi.

138; Cu 10, Si 4, Mg 0.3, Fe 1; permanent-mold castings for flat iron sole plates; retains strength and hardness at elevated temperatures; ts, 28,000 psi.

142; Cu 4, Mg 1.5, Ni 2; sand and permanent-mold castings for pistons and aircooled cylinder heads; ts, 27-47,000 psi.

195; Cu 4.5, Si 0.8; sand castings for general structural purposes; ts, 32-40,000 psi.

B195; Cu 4.5, Si 2.5; permanent-mold castings for general structural purposes; ts, 39-45,000 psi.

212; Cu 8, Si 1.2; sand castings for general purposes; ts, 23,000 psi.

214; Mg 3.8; sand castings; ts, 25,000 psi. For marine fittings, machine parts; has high resistance to salt-water corrosion.

A214; Zn 1.8, Mg 3.8; permanent-mold castings for marine fittings and hardware; ts, 27,000 psi.

218; Mg 8; ts, 42,000 psi; furnished as die castings for marine fittings and hardware.

220; Mg 10; sand castings; ts, 46,000 psi; for aircraft fittings, railroad car parts, heavy-duty castings, power shovel dipper parts, marine applications; high-strength sand-casting alloy.

355; Cu 1.3, Si 5, Mg 0.5; permanent-mold and sand castings; ts, 28-45,000 psi. For cylinder heads and crankcases for diesels and liquid-cooled aircraft engines.

356; Si 7, Mg 0.3; permanent-mold and sand castings; ts, 25-40,000 psi. For high-strength pressure-tight castings of intricate shape.

360; Si 9.5, Mg 0.5; die castings; ts, 42,000 psi; general-purpose alloy for large, intricate castings; a substitute for alloy 113 for castings to be made in a cold chamber machine.

380; Cu 3.5, Si 8.5; ts, 45,000 psi; a high-strength general-purpose die casting alloy.

113; Cu 7, Si 2, Zn 1.7; sand and permanent-mold castings; ts, 24-28,000 psi. For crankcases, oil pans, cylinder heads, and other automotive applications.

152; Cu 7, Si 5.5, Mg 0.3; permanent-mold castings; ts, 29-35,000 psi. For automotive pistons.

B214; Si 1.8, Mg 3.8; sand castings; ts, 20,000 psi. For pipe fittings, etc.; has high resistance to salt water corrosion.

F214; Si 0.5, Mg 3.8; sand castings; ts, 20,000 psi. For architectural applications and hardware; provides light-colored anodic coating.

319; Cu 3.8, Si 6; sand and permanent-mold castings; ts, 29-40,000 psi. For general purposes.

333; Cu 3.8, Si 9, Mg 0.4; permanent-mold castings; ts, 32,000 psi. For automotive pistons.

750; Cu 1, Ni 1, Sn 6.5; permanent-mold castings. Ts, 20,000 psi. For bearing inserts in high-duty internal combustion engines as connecting rod, main and thrust bearings.

ALCUPLATE (Composite aluminum-copper)—General Plate Div. of Metals and Controls Corp., Attleboro, Mass.

Aluminum on copper or copper on aluminum laminated material. Al 90, Cu 10; Al 80, Cu 20; Al 70, Cu 30; furnished in straight and coiled strips and in sheets. Hardness number, as specified. For electrical connectors, terminals, clamps, etc., wherever copper and aluminum are used.

ALDECOR (Alloy steels)—Alloys Development Co. Pittsburgh, Pa.

Steel containing molybdenum, copper, silicon and phosphorus, furnished in rough bars or billets, finished rods or bars, straight and coiled strip, sheets and plates for turning, boring, forging, stamping and welding. In untreated state: Ts, 70,000 psi min; ys, 50,000 psi min; elong in 2 in., 22 per cent min; sp gr is same as ordinary steel; weldability, good; resists corrosion caused by atmospheric exposure; abrasion resistance, medium. Used in transportation equipment to reduce dead-weight. Also produced by Republic Steel Corp.

ALLCAST (Aluminum alloy)—The National Smelting Co., Cleveland 5.

Nominal composition; Cu 3.5, Si 6; furnished in ingots for sand, precision and permanent-mold castings. Typical properties as-sandcast, untreated, ts, 28,000 psi; ys, 17,000 psi; elong, 2.5; Bhn, 70. Range of typical properties under various heat treatments; ts, 37,000-47,000 psi; ys, 24,000-42,000 psi; elong, 1.0-3.0; Bhn, 85-105. Sp gr, 2.73; nonmagnetic; weldability, good, abrasion resistance, medium. A general all-purpose aluminum alloy which is used in the as-cast or heat-treated condition, to meet a variety of applications, ranging from ornamental to highly stressed castings.

ALLEGHENY LUDLUM (Alloy Steels)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

"4750"; a high permeability nickel-iron alloy containing approximately 48 per cent nickel, balance iron, that must be hydrogen annealed after fabrication. Available in form of sheets, flats, squares, strip, etc.; also in the form of laminations and shields. Used in audio transformers, sensitive relays, and electrical instruments.

"88-x"; a nonmagnetic high-strength alloy material, not at all stainless, which finds applications for mountings in power transformers, and on high-current bus boards in power generating stations and substations. Typical analysis—C .3, Mn 10, Ni 8, bal., Fe.

Electrical steels; furnished in coiled strip and sheets for manufacture of laminations. Used in construction of motors, transformers, relays, electromagnets, radios, etc. These steels contain ½-5 per cent silicon, depending on the application.

Relay steels; annealed silicon steel rounds, flats, squares, etc., containing ½-2¾ per cent silicon, which find wide application for relays, electromagnets, etc.

Laminations for transformers, motors, and miscellaneous small electrical equipment and parts. Made from all grades of silicon steel and from high permeability alloys, such as Allegheny Ludlum "4750" and Allegheny Ludlum Mumetal.

Cast resistance grids: No. 17 metal. Castings having high electrical resistance and ability to withstand continued severe mechanical shock even at high temperatures. Applications include motor starters, crane motor controls, mine locomotive controls, and power house equipment.

ALLEGHENY METAL, STAINLESS CLAD (Stainless-clad mild steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Combination of mild steel and stainless steel; in sheets, strips, and plates; for general fabrication; corrosion resistant. Combines qualities of the stainless steel and plain steel of which it is composed.

ALLEGHENY METALS (Stainless Steels)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Standard stainless steels of AISI type. For type, application and characteristic data see "Stainless Steels" listing at end of this section.

ALLYMER (Allyl resin monomers)—Pittsburgh Plate Glass Co., Columbia Chemical Div., Barberton, O.

A complete line of allyl resin monomers formerly known as Columbia resins and designated as C. R. 39, etc. The numbers such as 38 and 149 continue to designate types. Various compounds such as Fiberglas base and allyl resin, allyl alcohol base resin, paper-base and allyl resin, cotton-cloth and allyl resin, for both C.R. 39 and C.R. 149 types are available. Thermosetting; furnished in sheets, rods or tubes and laminated form. Properties for these materials include corrosion, heat and impact resistance, high tensile strength and low moisture absorption.

ALMET (Stainless steels)—Alloy Metal Wire Co., Inc., Prospect Park, Pa.

Standard stainless steels of AISI types. For type numbers, characteristics and properties see "Stainless Steels" listing at end of this section.

ALNICO (Permanent magnet alloy)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Have high coercive force and high magnetic energy. Seven grades are available—Nos. 1, 2, 3, 4, 5, 6, and 12—each with different combinations of the basic ingredients aluminum, nickel, and cobalt and different magnetic properties. All seven grades can be cast, but only Alnico 2 and 4 are commercially available in sintered form. Sintered and cast Alnico furnished by General Electric and the following licensees: Cast Alnico only furnished by the following: Belden Mfg. Co., Chicago; Taylor Wharton Iron & Steel Co., High Bridge, N. J.; and Thomas & Skinner Steel Products Co., Indianapolis. Sintered Alnico only furnished by Stackpole Carbon Co., St. Marys, Pa.

ALRAY (Electrical resistance alloys) — Alloy Metal Wire Co., Inc. Prospect Park. Pa.

A; Cr 20, Ni 80. Furnished in flat wire, rod and strip. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont. serv. temp. 2000 F; has good weldability.

C; Cr 15, Ni 62, balance Fe. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont. serv. temp, 1700 F.

D; Cr 18, Ni 35, balance Fe. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont. serv. temp, 1400 F.

AlSiMag (Ceramics)—American Lava Corp., Chattanooga, Tenn.

Ceramics of various grades and compositions, each with special chemical, electrical and physical properties.

35 and 196; steatite possessing high mechanical strength with low electrical losses at high frequency for use in most electrical and electronic applications.

243; forsterite; very low electrical losses at high frequency.

197; steatite with high dielectric and mechanical strength, low dielectric leakage at elevated temperatures.

72 and 202; cordierite; resistant to heat shock for combustion tips and thermocouple insulators.

222; refractory material which can be machined in the fired state.

192; special hard material with high polish for thread guides; resists corrosion except hydrofluoric acid.

ALUMINWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

5% silicon-aluminum-alloy electrode for arc-welding aluminum in any form—cast, sheet, shapes, or extruded forms. For either metallic or carbon arc welding. Welds are very dense without porosity and possess high tensile strength.

AMBERLITE (Plastics resin adhesive)—Resinous Products & Chemical Co., Philadelphia 5.

Phenolic resin adhesive, furnished in powder form; has low moisture absorption, high density. Used in manufacture of waterproof plywood for aircraft and marine use.

AMBRAC (Copper-nickel-zinc alloy) — American Brass Co., Waterbury, Conn.

Alloy 850; Cu 75, Zn 5, Ni 20; high ductility. Used for condenser tubes, etc.

AMERICAN (Bonded metals)—American Nickeloid Co., Peru, Ill.

Chromium, nickel, brass, copper, gold resemblance and colors bonded to base metals such as steel, tin-plate, zinc, brass, copper, aluminum and nickel silver. Available in brilliant finishes and patterns as sheets, flat strips, coiled strip and round edge flat wire. Can be supplied with gum-adhered paper covering protecting prefinish in drawing and preforming.

Copper steel; copper plated to steel, latter serving as rust resistant, inexpensive metal, conserving quantities of critical solid copper. Available in polished and unpolished finishes in sheets, flat strips and coiled strip for continuous feed automatic presses.

AMERICAN (Felt)—American Felt Co., Glenville, Conn.

Felt material furnished in sheet, rods or tubes; for machining, stamping and extruding into parts. Abrasion resistance for certain felts is low, while for others high; resists corrosion caused by neutral conditions; heat-resistant to 250 F; flexibility, low, medium or high (as specified); moisture absorption also as specified; produced in any color. For oil retaining, dust excluding, filtering and vibration dampening.

AMERICAN Marine Genuine (Babbitt)—United American Metals Corp., Brooklyn 22, N. Y.

Furnished in bars. In cold-worked state; ts, 8750 psi; comp str, 10,140 psi; ys, 8000 psi; elong in 2 in., 1.00 per cent. For heavy-duty marine engines.

AMERICAN (Plywood) — American Plywood Corp., New London, Wis.

Phenolic urea plywood furnished in sheet and laminated form; for machining into parts. Abrasion resistance, medium; heat resistant to 300 F; flexibility, high; ts, 12,000 psi; moisture absorption, medium; inflammable; shatterproof; opaque; can be highly polished.

AMERIPOL (Synthetic rubber)—The B. F. Goodrich Co., Akron, O.

Oil-resisting and heat-resisting synthetic rubber; compounded and vulcanized to give wide range of properties. Ts, approx 4000 psi. In uncompounded form, has specific gravity of 1. For grease seals, packing rings, grommets and washers.

AMEROID (Casein thermoplastic) — American Plastics Corp., New York 1.

Furnished in rods or sheets for machining. Abrasion resistance, medium; resistant to weak acids and organic solvents; softens when exposed to weak alkalies; decomposes when exposed to strong acids or alkalies. Max cont. serv. temp, 150 F; flexural str, 10,000-18,000 psi; dielectric str, 400-700 volts per mil; ts, 10,000 psi; comp str, 27-53,000 psi; impact str, 1.0 ft lb (Izod); produced in colors; moisture absorption, medium; sp gr 1.34; translucent and opaque; machinability, good; Bhn 23. Used for bushings, knobs, etc.

AMMONODUCT (Butt-welded steel pipe)—Bethlehem Steel Co., Bethlehem, Pa.

Cold bending, butt-welded steel pipe for refrigeration purposes.

AMPCOLOY (Copper-base alloys)—Ampco Metal Inc., Milwaukee 4.

Grade A-3; Cu 89, Al 10, Fe 1; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good properties to 1000 F; ts, 70,000 psi; ys, 26,000 psi; bhn, 3000-kg, 115; fair abrasion resistance; high ductility; nonmagnetic; good bearing properties. Used for bushings, bearings, and pickling equipment. Can be forged and welded.

Grade A-323; heat-treated, to A-3 analysis above. Furnished as sand or centrifugal castings, rods and bars. Corrosion-resistant. Good physical properties to 750 F; ts, 80.000 psi; ys, 40.000 psi; bhn, 3000-kg, 145; high ductility; good abrasion resistance; nonmagnetic; excellent bearing properties. Used for bushings, bearings, gears and sleeves; also screw-down nuts; can be forged and welded.

Grade E-1; analysis similar to A-3 above; furnished as sand or centrifugal castings. Corrosion-resistant. Good physical properties to 1000 F; ts, 75.000 psi; ys, 30,000 psi; bhn, 3000-kg, 140; fair abrasion resistance; fair ductility; nonmagnetic; good bearing properties. Used for bearings, bushings, gears and pickling equipment.

Grade E-117; analysis similar to A-3 above. Heat-treated. Furnished as sand or centrifugal castings. Corrosion-resistant. Good physical properties to 750 F; ts, 90 000 psi; ys, 66,000 psi; bhn, 3000-kg, 225; good abrasion resistance; nonmagnetic. Finds use in special applications. Can be welded or forged.

Grade 46-22; Cu balance, Al 10-11, Fe 4-6, Ni 4-6; furnished as sand castings, rods or bars. As heat-treated: Ts, 110,000 psi; ys, 60.000 psi; elong 10 per cent; reduction of area, 8 per cent; bhn, 3000-kg, 217-348. For use where strength with ductility is required. Can be forged and welded.

62, 64 and 66; a series of low, medium and high-strength manganese bronzes. Furnished as sand or centrifugal castings. Ts, from 65-110,000 psi; ys, 30-65,000 psi; bhn, 3000-kg, 115-215. Finds many uses for structural parts not requiring best bearings for characteristics. Can be readily forged and all three grades are weldable.

86; beryllium-copper; Cu 96.3; Be 2.5; Ni 1.2; furnished as sand or centrifugal castings; heat-treated, ts 100,000 psi; ys, 90,000 psi; bhn, 3000-kg, 400. Used for welding dies and safety tools.

91 and 97; high conductivity copper-chromium and copper-cobalt, beryllium alloys; supplied as sand or centrifugal castings; before final heat treatment can be forged; high electrical thermal conductivity. Used as welding wheels, electrodes, collector rings, collector shoes, current-carrying parts of electrical and other machinery.

Grade 342; Cu 75, Sn 5, Pb 20. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 31,000 psi; ys, 18,000 psi; elong in 2 in., 14 per cent; bhn (500-kg) 57; nonmagnetic; weldability, poor; corrosion resistance, high. For soft bronze bearings, bushings, seals, seat rings, etc.

Grade 346; Cu 80, Sn 10, Pb 10. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 48,000 psi; ys, 25,000 psi; elong in 2 in., 15 per cent; bhn (500-kg) 78; nonmagnetic; for general-purpose bronze bearings, bushings, seals, seat rings, etc.

Grade 351; Cu 75, Sn 10, Pb 15. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 40,000 psi; ys, 22,000, psi; elong in 2 in., 13 per cent; bhn (500-kg) 72; nonmagnetic; corrosion resistant to weak acids such as mine waters. For bearings, bushings, pump seals, valve seats, etc.

Grade 382; Cu 83, Sn 7, Pb 7, Zn 3. Furnished in 10-ft lengths of continuous-cast bars. Untreated, ts is 44,000 psi; ys, 22,500 psi; elong in 2 in., 24 per cent; bhn (500-kg) 76; nonmagnetic. For general-purpose bearings, bushings, seals, etc.

Grade 384; Cu 85, Sn 5, Pb 9, Zn 1. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 42,000 psi; ys, 21,000 psi, elong in 2 in., 20 per cent; bhn (500-kg) 67; nonmagnetic; for general-purpose bearings, bushings, seals, etc.

Grade 583; Cu 84, Sn 10, Pb 2.5, Ni 3.5. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 50,000 psi; ys, 30,000 psi; elong in 2 in., 20 per cent; bhn (500-kg) 85; nonmagnetic. For high-strength bearings, bushings, etc.

Grade 742; Cu 88, Sn 10, Zn 2. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 52,000 psi; ys, 27,000 psi; elong in 2 in., 22 per cent; bhn (500-kg) 85; nonmagnetic. For hard bronze gears, bearings, bushings, valve stems, shafting, seat rings, etc.

Grade 782; Cu 85, Sn 5, Pb 5, Zn 5. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 43,000 psi; ys, 22,000 psi; elong in 2 in., 25 per cent; bhn (500-kg) 67; nonmagnetic. For bearings, bushings, pump seals, valve seats, etc.

Grade 40; Al 9.5-10.5, Fe 0.20 max, Cu balance. Furnished in rough bars or billets and finished rods and bars. Untreated, ts is 70,000 psi; ys, 25,000 psi; elong in 2 in., 20 per cent; bhn (3000-kg), 130; nonmagnetic; resists sulphuric acid. For pump valves in acid service, etc.

Grade 44; Al 11-12, Fe 0.20 max, others 0.25 max, Cu balance. Furnished in centrifugal castings, rough bars or billets and wire. Untreated, ts is 70,000 psi; ys, 35.000 psi; elong in 2 in., 2 per cent; bhn (3000-kg), 185. For welding dies, electrode holders, flash and butt welding jaws, etc.

Grade 45-22; Al 9.7-10.9, Fe 2.0-3.5, Ni 4.5-5.5, Mn 1.5 max, others 0.5, Cu balance. Furnished as castings, rough bars or billets, and finished rods and bars. Heat treated, ts is 105,000 psi; ys, 55,000 psi; elong in 2 in., 10 per cent; bhn (3000-kg) 200; non-magnetic; weldability, good; resists weak acids. For gears, bearings, shafts, etc.

Grade 50; Cu 83-85; Sn 9.5-10.5, Pb 2-3, Ni 3-4, others 0.25 max. Furnished in form of rough bars or billets. Untreated, ts is 40,000 psi; ys, 22,000 psi; elong in 2 in., 15 per cent; bhn (500-kg), 80; nonmagnetic; weldability, poor; abrasion resistance, medium. For worm gears where speeds are high with light to moderate loads.

Grade 71; Cu 86-90; Sn 5.5-6.5; Pb 1-2; Zn 3-5, P 0.05 max, Fe 0.25 max, Ni 1.0 max, others 0.2 max. Furnished in form of rough bars or billets. Untreated, ts is 34,000 psi; ys, 16.000 psi; elong in 2 in., 22 per cent; bhn (500-kg), 60; nonmagnetic. For pressure castings, gears, bushings, bearings, etc.

Grade 72; Cu 86-89, Sn 7.5-9.0, Pb 0.3 max, Zn 3-5, P 0.05 max, Ni 1.0 max, others 0.2 max. Furnished in form of rough bars or billets. Untreated, ts is 40,000 psi; ys, 20,000 psi; elong in 2 in., 20 per cent; bhn (500-kg), 60; nonmagnetic; weldability, fair. For bushings, bearings, etc.

Grade 74; Cu 84-86, Sn 4-6, Pb 4-6, Zn 4-6, P 0.05 max, Fe 0.3 max, Ni 1.0 max, others 0.2 max. Furnished in rough bars or billets and sand and permanent-mold castings. Untreated, ts is 30,000 psi; ys, 18,000 psi; elong in 2 in., 20 per cent; bhn (500-kg), 55; nonmagnetic; weldability, fair. For valves, pipe elbows, etc., for applications up to 350 lb.

Grade 79; Cu 86-89, Sn 9-11, Pb 0.3 max, Zn 1-3, P 0.05 max, Fe 0.15 max, others, 0.2 max. Furnished in rough bars or billets. Untreated, ts is 40,000 psi; ys, 20,000 psi; elong in 2 in., 16 per cent; hardness, 70 rockwell F; nonmagnetic; weldability, fair; abrasion resistance, medium. For bushings, bearings, gears, etc.

AMPCO METAL (Copper-base alloys)—Ampco Metal Inc., Milwaukee 4.

Grade 12; Cu balance, Al 8.5-9.3, Fe 2.50-3.25, others 0.50 max; furnished as sand or centrifugal castings; rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 70,000 psi; ys, 28,000 psi; comp str, 120,000 psi; sp gr, 7.73; bhn, 3000-kg., 115; elong, 25 per cent min; abrasion-resistant; nonmagnetic. Good machinability, can be forged and welded.

Grade 15; Cu balance, Al 9-10, Fe 2.75-4.0, others 0.50 max; furnished as solid or hollow rods and bars or sheet. Corrosion-resistant. Good physical properties to 1000 F; ts, 35,000 psi; ys, 40,000 psi; sp gr, 7.62; bhn, 3000-kg, 160; elong, 25 per cent; abrasion-resistant; nonmagnetic; has good surface finish; good bearing qualities. Used for bushings, bearings, small worm wheels, bolts, nuts or studs.

Grade 18-13; Al 10.30-11.0, Fe 3-4.24, other 0.50 max, balance Cu. Furnished in form of rough bars or billets, finished rods and bars, and sand and permanent-mold castings. Heat treated, ts is 80,000 psi; ys, 32,000 psi; elong in 2 in., 16 per cent; bhn (3000-kg), 150; nonmagnetic; max cont. serv. temp, 400 F. Uses similar to Grade 18.

Grade 18-22; Al 10.30-11.20, Fe 3.0-4.25, others 0.50 max, balance Cu. Furnished as rough bars or billets, finished rods and bars, and permanent-mold and sand castings. Heat treated, ts is 95,000 psi; ys, 50,000 psi; elong in 2 in., 4 per cent; bhn (3000-kg), 212; nonmagnetic; weldability, good; abrasion resistance, high; max cont. serv. temp, 400 F. For bearings, guides, wear strips, etc.

Grade 16; Cu balance, Al 9.80-10.30, Fe 3-4, others 0.50 max; furnished as sand or centrifugal castings. Corrosion resistant. Good physical properties to 1000 F; ts, 85,000 psi; ys, 32,000 psi; comp str, 125,000 psi; sp gr, 7.62; bhn, 3000-kg, 140; elong, 20 per cent; abrasion-resistant; nonmagnetic. Used for bushings, bearings, gear slides and shifter forks. Good machinability; can be forged and welded.

Grade 18; Cu, balance, Al 10.30-11.0, Fe 3.0-4.25, others 0.5 max; furnished as sand or centrifugal castings; also as rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 85,000 psi; ys, 35,000 psi; comp str, 136,000 psi; sp gr, 7.58; bhn, 3000-kg, 170; elong 16 per cent; abrasion-resistant; nonmagnetic. Used as heavy-duty bushings, bearings, gears, worm wheels, feed nuts and pickling equipment. Fair machinability.

Grade 18-23; heat-treated version of Grade 18 above. Furnished as sand or centrifugal castings, rods or bars. Corrosion resistant. Good physical properties to 750 F; ts, 100,000 psi; ys, 45,000 psi; comp str, 15,000 psi, sp gr, 7.60; bhn, 3000-kg, 190; elong 14 per cent; abrasion-resistant; nonmagnetic. Used where high strength, good bearing properties and wear resistance is required. Ideal for heavy-duty worm gears.

Grade 20; Cu, balance, Al 11.40-12.20, Fe 3.25-4.50, others 0.5 max; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 85.000 psi; ys, 38,000 psi; comp str, 146.000 psi; sp gr 7.43; bhn, 3000-kg, 230; high abrasion resistance; nonmagnetic. Used as cams, cam rollers, welding jaws, bushings and bearings (wherever high resistance is required).

Grade 21; Cu, balance, Al 12.60-13.40, Fe 3.5-5.0, others 0.50 max; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 75,000 psi; ys, 45,000 psi; comp str 160,000 psi; sp gr 7.14; bhn, 3000 kg, 300; high abrasion resistance; nonmagnetic. Used in drawing and forming dies, bushings and liners, replacing steel.

Grade 22; Cu, balance, Al 13.7-14.4, Fe 4.0-5.25, others 0.50 max; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 80,000 psi; ys, 60,000 psi; comp str, 171,000 psi; sp gr, 7.21; bhn, 3000-kg, 330; high abrasion resistance; nonmagnetic. Used as cam rollers, wear strips, forming and drawing dies. Can be forged and welded.

AMPCO-TRODE (Coated aluminum-bronze welding rod)—Ampco Metal Inc., Milwaukee 4.

Used for weldrod overlays on steel, cast iron, brass or bronze; repairing with high-strength bronze rod of practically all metals.

AMSCO (Steel castings and welding rods)—American Manganese Steel Division of American Brake Shoe Co., Chicago Heights, Ill.

Manganese steel castings; C 1-1.40, Mn 10-14, Si 0.25-1.00, P 0.10 max, balance Fe. Ts (heat treated), 100-135,000 psi; ys, 30-55,000 psi; elong in 2 in., 30-55 per cent; bhn, 200; magnetic permeability, 1.03-1.10; weldability, good; max cont. serv. temp, 500 F; abrasion resistance, medium. For dippers, gears, plows, oil well parts, chains, crusher parts, bucket lips, spindles, guides, conveyor parts, dredge buckets, etc.

Chromium-Molybdenum Steel; sand castings to specification. For liners and grates for ball mills.

Chromium molybdenum steel; sand castings to specifications. For liners and grates for ball mills.

Mang-Co (Welding rod); C-Mn-Si; for build-up welding only on austenitic manganese or carbon steel; as-welded hardness, Bhn 200; work hardens to 400-500 Bhn. For building up quarrying, mining, excavating, and construction equipment wearing parts.

No. 459 (Welding rod); Cr-Mo-Ni-Mn-Si-C. For hard surfacing only; Bhn, 500-600; resists most acids. Martensitic iron deposits; slightly magnetic; high abrasion resistance; mild impact. For hard facing machine parts subject to extreme abrasion and mild impact such as pug mill knives, mixer blades, brick dies, pulverizer hammers, muller tires, rolling mill guides, hog anvils, car retarded beams and parts, etc.

No. 217 (Welding rod); W-Cr-Mo-C; for hard facing only. Bhn, 600-700; resists most acids; martensitic iron deposits, slightly magnetic, extreme abrasion resistance. For hard facing machine parts subject to extreme abrasion at normal and elevated temperatures up to 1000 F, such as conveyor screws, muller plows, coke pusher shoes, pick up shoes, rolling mill guides, carbon scrapers, pinch rolls, etc.

Mo-Mang manganese (Welding rod); C-Mn-Si-Mo; for build-up welding austenitic manganese steel castings and rolled shapes; as-welded hardness, Bhn 200; work hardens to 450-500 Bhn. Austenitic steel deposits nonmagnetic; highly resistant to impact, wear and abrasion. For build-up welding on dipper lips, hammer mill parts, dredge pump shells, stone crusher equipment, etc.

Nickel manganese (Welding rod); C-Mn-Ni-Si; for welding austenitic manganese steel castings and rolled shapes; as-welded Bhn, 200; work hardens to 450-500 Bhn; austenitic steel deposits nonmagnetic. For austenitic manganese steel frogs, crossings, dippers, dipper teeth repointers. Also quarrying, logging, oil, construction, mining, steel mill and excavating equipment wearing parts.

Farmface (Welding rod); Cr-Mo-Ni-C-Si; for hard facing only; Bhn, 500-600; martensitic iron deposits, slightly magnetic; high abrasion resistance; no heat treatment required; scours easily; high fluidity; easy flowing. For hard facing agricultural parts, such as plow shares, cultivators, shoes, corn planter runners, lister shares, plow disks, cylinder teeth, etc.

Ni-Hard (Welding rod); C-Si-Ni-Cr; for hard facing only; Bhn, 500-600; martensitic iron deposits, magnetic; for hard surfacing parts subject to extreme wear and medium impact.

Economy Hardface (Welding rod); C-Cr-Mo; for hard facing only; Bhn, 450-500; martensitic steel deposits, nonmagnetic. Self-hardening; high abrasion and severe impact resistance; responds to heat treatment; can be forged. For hard facing quarrying, excavating, mining, construction, and steel mill wearing parts.

Resistwear (Welding rod); Cr-Mo-Mn-C; for hard facing only; Bhn, 400-500; martensitic steel deposits, magnetic; abrasion and impact resistant. For hardfacing ferrous parts subject to extreme wear.

No. 1 (Welding rod); Co-Cr-W-Mn; for hard facing at elevated temperatures over 700 F; Bhn, 500-540; resists acids, bases and salts; high creep strength; solid solution and eutecticform matrix anchoring very hard crystals of complex carbides. High resistance to liquid and hot gas corrosion, abrasion and high resistance to softening at temperatures up to 1800 F. For hard facing wire guides, pump sleeves, carbon scrapers, mandrels, lathe and grinder centers, etc.

No. 6 (Welding rod); Co-Cr-W-Mn; for hard facing at elevated temperatures over 700 F; Bhn, 420-450; resists acids, bases and salts; high creep strength, stainless solid solution matrix containing complete scattered eutectic carbides. High resistance to liquid and hot gas corrosion and good resistance to softening at high temperatures up to 1800 F. For hard facing high-pressure, high-temperature steam valves, hot trimming dies, shear blades, exhaust valves, valve seats, locomotive valve gears, etc.

Dieweld (Welding rod); C-Cr-Mo; for hard facing only; Bhn, 500-600; martensitic steel deposits, magnetic; high abrasion and impact resistance, air hardening, responds to heat treatment, can be forged. For production of composite dies, shear knives, milling cutters, reamers, simple dies and molds, etc. For reclamation of worn shear knives, punches and molds; upset and drop forging dies and tools. For general hard facing.

Toolface (Welding rod); C-Cr-Mo-W-V; for hard facing only; Bhn, 550-650; martensitic steel deposits, magnetic, air hardening. High abrasion and impact resistance; responds to heat treatment and can be forged. For hard facing cutting tools, forging dies, for manufacture of composite tools. For general hard facing for extreme hardness and shock resistance.

Machine-Face (Welding rod); C-Cr-Mn; for hard facing only; as-welded hardness, Bhn 325-350; flame hardens to 500-600 Bhn; pearlitic steel deposits. Responds to flame hardening.

Railface (Welding rod); C-Cr-Mo; for hard facing only; Bhn, 325-350; high resistance to impact; for building up carbon steel frogs, crossings, and rail-ends.

ANACONDA (Copper-base alloys) — American Brass Co., Waterbury, Conn.

"85" Red Brass; Cu 85, Zn 15; pipe, tube and sheet forms; particularly resistant to salt water corrosion.

Super-Nickel; Cu 70, Ni 30; seamless tubes, sheets and plates. For severe condenser tube service and where resistance to salt water corrosion is desired.

Free cutting phosphor bronze; Cu 88, Sn 4, Zn 4, Pb 4; corrosion, heat and abrasion-resistant: combines general characteristics of standard phosphor bronze alloys with free-cutting qualities of yellow brass.

ANCHOR (Drill rod)—Anchor Drawn Steel Co., Latrobe, Pa.

Drill rods for use where toughness is required, and where minimum machining is necessary. Hardens with fine-grained tough case, and resists breakage. For pins, bushings, punches, dies, etc.

ANFRILOY (Bearing bronze)—Wellman Bronze & Aluminum Co., Cleveland.

A copper-lead-tin bearing bronze for high-speed, light-duty bearings and for bushings where pressure and thrust are not excessive.

ANTIMONIAL ADMIRALTY (Bronze) — Chase Brass & Copper Co., Waterbury 91, Conn.

Cu 71, Sn 1, Sb 0.05, Zn 27.95. Outstanding for general corrosion resistance and particularly for preventing dezincification. Recommended for condensers in the power plant and oil industries.

APEX (Nonferrous die casting alloys)—Apex Smelting Co., Chicago 12.

Aluminum, zinc and magnesium-base die casting alloys in slab, ingot, shot, and piglet form.

APOLLO (Prefinished cold-rolled steel)—Apollo Metal Works, Chicago 38.

Chromsteel; cold-rolled strip, nickel-chrome-plated steel, furnished in sheets and strips, for stamping into parts. Resists heat to 800 F; abrasion resistance, medium; weldability, fair. Used generally as substitute for brass and copper sheet and other critical metals when resistance to corrosion is essential or reflectivity is needed.

APW (Silver brazing alloys) — The American Platinum Works, Newark, N. J.

Various silver brazing alloys with melting points from 1134 F. For low-temperature bonding of ferrous and nonferrous metals. Furnished in form of wire, strip, rings and filings. Also APW fluxes for use with silver brazing alloys.

APW fine, sterling and coin silver sheet, wire, rods, blanks, circles, seamless tubing, fine silver anodes, gauze, foil and special apparatus.

APW platinum metals and alloys, plate, foil, wire tubing and special apparatus.

AQUAFLEX (Plastics tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Heavy-walled plastics tubing for conveying water and other liquids as well as for use as air hose. Can be supplied with proper metal fittings.

ARCOS (Arc welding electrodes)—Arcos Corp., Philadelphia 2, Pa.

Stainless steel and alloy arc-welding electrodes for welding all types of metals.

ARISTOLOY (SAE alloy, and special steels)—Copperweld Steel Co., Warren, Ohio.

Full range of SAE alloy steels, also aircraft, and special steels. Used for gears, both light and heavy-duty, clutches, shafts, and pinions; also in ball and roller bearings and aircraft parts, both for engine and plane use; stainless and Nitralloy steels. Also available are aircraft steels, stainless, Nitralloy, bearing steels, and carbon and alloy tool steels. In its Glassport, Pa., plant the company produces copper-covered steel wire, strand and rods.

ARMCO (Steels)—The American Rolling Mill Co., Middletown, O.

Stainless steels in standard forms to AISI Specs. For data on types, properties and characteristics see "Stainless Steels" listing at end of this section.

Tran-Cor 58; high silicon steel for distribution transformers. Grade 65; high silicon electrical steel sheets and strips with low core loss for power and distribution transformers. Grade 72; a medium silicon steel for large generators and transformers.

Tran-Cor X; medium-silicon electrical steel; furnished in straight and coiled strip and in sheet; annealed, ts is 60-65,000 psi; ys, 47-50,000 psi; elong in 2 in., 17-20 per cent; hardness, 75-79 rockwell B. For core laminations of power transformers.

Tran-Cor 52; high-silicon electrical steel; furnished in coiled and straight strip and in sheet; annealed, ts is 70-77,000 psi; ys, 61-65,000 psi; elong in 2 in., 2-4 per cent; hardness, 90-97 rockwell B. For distribution and power transformers where unusually low core loss is required.

Magnetic Ingot Iron; an open-hearth iron furnished in rough bars and billets, finished rods and bars, straight and coiled strip, sheet and plate. Annealed, ts is 45,000 psi; ys, 30,000 psi; elong in 2 in., 35 per cent; hardness, 40-45 rockwell B; magnetic; weldability, good. Primarily for cores of dc electrical equipment.

Galvanized Ingot Iron; an open-hearth iron furnished in straight and coiled strip and sheet. Annealed, ts is 45,000 psi; ys, 30,000 psi; elong in 2 in., 35 per cent; magnetic; for general sheet metal applications.

Galvanized Steel; various medium and low-carbon analyses, copper-bearing steel in coiled and straight strip and sheet; magnetic; weldability, fair. For general sheet metal applications.

Enameling Iron; an open-hearth iron furnished in straight and coiled strip and sheet; annealed, ts is 45,000 psi; ys, 30,000 psi; elong in 2 in., 35 per cent; hardness, 45 rockwell B; magnetic; weldability, good. For sheet metal parts to be porcelain enameled.

Intermediate Transformer; scale-free medium silicon steel sheet and strip for some transformer and special applications.

Special Electric; Scale-free medium silicon steel sheet and strip. Annealed: Ts, 54-65,000 psi; ys, 40-50,000 psi; elong in 2 in., 19-23; hardness, rockwell B, 70-85. For ac motors and generators, radio power pack transformers, etc.

Electric; low-silicon electrical steel furnished in sheet and strip. Annealed: Ts, 48-60,000 psi; ys, 30-45,000 psi; elong in 2 in., 21-28; hardness, rockwell B, 60-80. For laminations in electric motors and generators.

Radio No. 6; for applications in which superior low induction magnetic characteristics are important. No. 5; for audio transformer cores and other low induction applications. No. 4; good permeability at low induction; for chokes. Nos. 3, 2 and 1; for small transformers.

Ingot Iron; highly refined iron for magnetic cores; supplied in round and flat bar form.

Armco Ingot Iron; highly refined iron supplied in galvanized sheet for general sheet metal work; also hot-rolled annealed and cold-rolled sheets, plates and strip.

Aluminized; a special aluminum-coated sheet (strip or coil) with exceptional resistance to heat and corrosion.

ARMORPLY (Plywood)—United States Plywood Corp., New York.

Metal covered; furnished in sheet form; has high strength and low weight. For use in food machinery, laboratories, etc.

ARMSTRONG'S (Compositions of cork, rubber, fiber, and paper)—Armstrong Cork Co., Lancaster, Pa.

Compositions of cork and Neoprene, Buna N, Buna S, Thiokol, and butyl rubber. More than two dozen materials having a wide range of physical properties furnished in roll, sheet, cut gasket, molded, and extruded forms. Impervious to liquids and gases; highly resistant to deterioration by oils, solvents and most other liquids, gases, corona and weather; high and low coefficients of friction, high and low degrees of compressibility, lateral flow, etc.; available with or without fabric backing, with or without adhesive coating. Furnished to meet specific requirements. Used as gaskets, packings, washers, valve disks, feed rolls, polishing wheels, diaphragms, friction and vibration pads, etc.

Compositions of cork and natural rubber, for specific applications not requiring the special characteristics of synthetic rubber.

Synthetic rubber compounds for applications where requirements include properties such as resistance to oil, aromatic fuel, solvents, sunlight or electrical corona — and where lateral flow is necessary or not objectionable.

Straight cork compositions, ranging in density from 8 lb to 36 lb per cu ft, in compressibility from 5 to 60 per cent.

Fiber sheet packings including noncorrosive materials, for general gasketing.

Rag felt papers for vibration damping, space packing, anti-squeak lining and use as gaskets, dust seals, etc.

ASARCOLOY No. 7 (Cadmium-nickel bearing alloy)—American Smelting & Refining Co., New York.

Is capable of withstanding high compression loads and high operating temperatures. Ni 1.3, balance Cd. Furnished in ingots for spinning and permanent-mold castings. Resists heat to 300 F; high abrasion resistance; ts, 15,000 psi; comp str, 20,000 psi; sp gr, 8.7; bearing properties, good; weldability, good. Used for bearings.

ATHENIA (High carbon steel) — The Athenia Steel Co., Div. of National Standard Co., Clifton, N. J.

Cold-rolled, high-carbon flat steels in widths of 1/16-in. to 6½ in.; thickness, 0.0015 to 0.062-in. Custom-made steels of 0.60 carbon and higher. Entire range of annealed, hard-rolled, black-tempered, tempered and polished or tempered and polished with blue or straw-colored finish.

ATLAS No. 93 (Oil-hardening steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.55, Cr 0.65, Mo 0.35. For collets, studs and parts requiring toughness in hardened condition. Oil hardening. For use as bucket teeth, keys, pins, bolts, studs, etc.

AUROMET (Special bronzes)—Aurora Metal Co., Aurora, Ill.

Special aluminum bronzes, aluminum nickel bronzes, and silicone bronzes of several compositions. In untreated state: ts, 55-120,000 psi; ys, 25-85,000 psi; elong, 3-40%; hardness, 66-110 Rockwell B; sp gr, 7.4; nonmagnetic; weldability, good; resist corrosion caused by weak acids and salt solutions; resists heat to 750 F; abrasion resistance, medium. For use as impellers, pump parts, bushings, worm gears, highly stressed structural parts, and vibration dampeners.

AVIALITE (Copper-aluminum alloy)—American Brass Co., Waterbury, Conn.

Used for valve seats and guides in airplane motors.

"AW" (Rolled steel floor plate)—Alan Wood Steel Co., Conshohocken, Pa.

Furnished in four patterns to meet flooring problems in the industrial and transportation fields; designed to withstand heaviest traffic; oilproof, crackproof, heatproof, slipproof, and noiseless. Furnished in carbon, copper or alloy analysis; also available in other non-ferrous metals.

"AW" DYNALLOY (Alloy steel)—Alan Wood Steel Co., Conshohocken, Pa.

Alloy steel furnished in rough bars, sheets, and plates for welding, cold forming, hot forming, stamping, etc. Abrasion resistance, high; ts, 65-80,000 psi; ys, 50,000 psi; elong in 2 in., 25%; endurance limit (completely reversed bending), 45,000 psi; weldability, good. For welded structures requiring high strength, such as machine bases and tanks.

AZTEC (Asbestos packing)—Gatke Corp., Chicago 1.

Packing for high-pressure valve stems, rods and other machine elements; furnished in compressed sheet, oilproof plastics, twisted and braided stock and wire-interwoven sheet.

B

B-50 (Powder metal)—Powdered Metal Products Corp., Franklin Park, Ill.

High copper content; furnished in pressed and sintered parts to specification; imp str (Izod) 2 ft-lb; Rockwell hardness, H 60; abrasion resistance, medium; for bushings, bearings, etc.

BAKELITE (Plastics)—Bakelite Corp., New York 17.

Phenolic plastics, general purpose; thermosetting; furnished in granular form for plastic molding; corrosion-resistant, dielectric strength at 60 cycles, 270-350 volts per mil.; nonflammable; ts, 6000-11,000 psi; low thermal conductivity; available in dark colors; takes high polish; low moisture absorption.

Phenolic plastics, mineral filled. Similar to above. Has high heat resistance, low moisture absorption; and is nonflammable.

Phenolic plastics, fabric-filled. Similar to general purpose phenolic plastics but are much higher in impact resistance; abrasion-resistant; impact strength (Izod) .23-2.7 ft-lb energy to break. Used for gears, bushings, bearings and heavy-duty parts.

Polyéthylene; thermoplastic; has good resistance to softening by higher temperatures than any other similar material previously produced. Its outstanding characteristic is its unusually good electrical properties. It has extremely low coefficient of moisture absorption and water vapor transmission; resists the effects of practically all chemicals; is inherently flexible; can be produced as molded or extruded goods, sheet materials, film, sheeting, or any of the other usual forms of plastic materials.

Polystyrene plastics; thermoplastic; furnished in powder form for molding; transparent, translucent and opaque effects, in all colors; takes high polish; nonflammable; low moisture absorption; sp gr. 1.05-1.07; dielectric strength at 60 cycles 500-525 volts per mil; volume resistivity 10 deg megohm centimeters; power factor .0002-.0003 from 60 cycles to 50,000,000 cycles; offers exceptional resistance to acids and alkalis.

Cast resins; produced as BT 44, 45, 48, 55 and 58 types; in rods, sheets, tubes and many special types of castings. BT 44, 45 and 55 are opaque, translucent and mottled; corrosion resistant; of high dielectric strength; low moisture absorption; available in colors. Used for radio cabinets, etc. BT 48 and 58 are crystal clear, transparent colors of any hue; and mottled transparents. Available as castings including rods, sheets and tubes; highly resistant to acids. Used in place of glass and can be readily machined and used for gages, peep holes, etc.

BT 61-893; available in plates only; transparent water white; very stable; color-fast; excellent in dimensional stability. Used for photoelastic stress study work.

BT 41-001; available in transparent amber castings and sheets made to order; resistant to hydrofluoric acid. Used where very high dielectric strength and low moisture absorption properties are required.

BT-48-306; nonstatic, used for instrument windows and recommended under Navy specifications. This material has high light transmission qualities.

BAKER (Precious metals)—Baker & Co. Inc., Newark 5, N. J.

Platinum and alloys for linings, contacts, thermocouples, furnace resistors, etc.

BCM (Thermosetting low-pressure laminating resin)—E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

Supplied as liquid monomer, non-volatile and of low viscosity which polymerizes rapidly and speeds up polymerization of other monomers. Polymer exceptionally hard and scratch-resistant. Combined with thermoplastic polymer to form impregnating resin exceptionally convenient to handle. Laminated structural parts, tooling jigs, etc.

BEARITE (Babbitt metal)—A. W. Cadman Mfg. Co., Pittsburgh.

Babbitt metal furnished in ingots and 50-lb pigs; Bhn at 70 F, 29.1; at 212 F, 24.4; comp str, 15,000 psi. For rotary bearings subjected to heavy loads and extreme speed.

BEARIUM METALS (High-lead bronzes)—Bearium Metals Corp., Rochester, N. Y.

High lead bronzes with specially prepared metallurgical structure providing good frictional properties.

Grade B-4; Cu 70, Sn 4, Pb 26. Furnished as rough cored or solid bars, as sand castings, machined bushings, and in long lengths for screw machine use. Ts, 21,000 psi; comp str, 9750 psi; Bhn, 40. Abrasion resistance, high; low coefficient of friction; high ductility. Resists corrosion caused by acids. Used for bushings, bearings, packing, piston rings, and seals.

Grade B-8; Cu 70, Sn 8, Pb 22. Furnished in rough cored or solid bars, rough castings, machined bushings, screw-machine rod stock. Ts, 25,000 psi; comp str, 11,500 psi; Bhn, 50. Abrasion resistance, high; low coefficient of friction; high ductility. Resists corrosion caused by acids. Good bearing properties. Used for bearings, bushings, packing and piston rings, seals, cross-head shoes, etc.

BEETLE (Urea-formaldehyde plastics)—Plastics Division, American Cyanamid Co., New York 20.

Thermosetting; furnished in powder or granules for molding purposes. Available in colors, translucent and opaque. Dielectric str, 300-350 volts per mil; ts, 5000-7000 psi; comp str, 20-24,000 psi; flexural str, 11-18,000 psi; shatterproof; moisture absorption, low; bhn 78.9; nonflammable. Used for housings, cabinets, knobs, dials and insulators.

BELECTRIC (Special cast iron)—Belle City Malleable Iron Co., Racine, Wis.

Furnished as sand castings. Ts, 35-60,000 psi; high compressive strength; good bearing properties; recommended heat treatments are the same as for standard gray iron; Bhn, untreated, 179-285; heat treated, 300-550. Used where rigidity, wearability, or where strong high grade gray iron might be applied.

BELECTROMAL (High-strength malleable iron)—Belle City Malleable Iron Co., Racine, Wis.

High-strength malleable iron furnished as sand castings. Ts, 60-70,000 psi; high ductility; Bhn, untreated, 140-170. Recommended for castings for automotive, railroad, tractor and implement work.

BELMALLOY (Pearlitic malleable iron)—Belle City Malleable Iron Co., Racine, Wis.

Pearlitic malleable iron, electric furnace melted and continuous-oven annealed. Ts, 70,000 psi min; ys, 45,000 psi min; elong, 5% min; Bhn, 179-217. Used for castings of machining quality requiring strength and shock resistance.

BENDIX (Flexible metal hose)—Metal Hose Div., Bendix Aviation Corp., Teterboro, N. J.

Corrugated seamless tubing of various alloys. Used for exhausts, oil lines, vibration eliminators, etc.

BENELEX "70" (Wood-fiber sheet)—Masonite Corp., Chicago.

Furnished ¼-2 in. thick; max cont serv temp, 150 F; dielectric strength (volts per mil inst.), 190; ts, 7700 psi; comp str, 26,500 psi; available in the color brown; is shatterproof; sp gr, 1.41; is opaque; machinability, good; hardness, Rockwell M, 90. For dies, fixtures and electrical equipment.

BERALOY "A" (Beryllium-copper alloy)—Wilbur B. Driver Co., Newark, N. J.

Beryllium-copper alloy; Cu 97.75, Be 2, and Co 0.25; furnished in soft annealed state or in slightly cold-worked conditions for easy machining and forming into parts. Ts, 66,000 psi in annealed state, can be increased to 175,000 psi by simple hardening treatment at 600 F; and by cold work after solution anneal, ts can be increased to 200,000 psi. Used for electrical spring parts, contacts, switch jaws, diaphragms, switch parts, bearings, connectors, valves, cams, etc.

BERYLCO (Beryllium-copper)—Beryllium Corp., Reading, Penna.

No. 25; Be 1.9-2.1, Co 0.15-0.25, balance Cu; furnished as rough bars or billets, finished rods or bars, strips, tubing and wire; for sand castings, die castings, turning, boring, forging, stamping and welding. In heat-treated state; ts, 175-200.000 psi; ys, 146-179,000 psi; elong, 2-10%; impact resistance, high; sp gr, 8.23 + or — 0.02; nonmagnetic; weldability, good. Resists corrosion caused by salt water and alkalies. Heat resistant to 450 F; abrasion resistance, high. Used for bushings, cams, worm gears, valve bodies, etc.

No. 10; Be 0.60, Co 2.50, balance Cu. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, and wire. Heat-treated; ts, 90-125,000 psi; ys, 50-60,000 psi; elong in 2 in., 10-15%; hardness, Rockwell B, 92-108; nonmagnetic; weldability, good; resists corrosion by atmosphere and salt water; max cont serv temp, 750 F; abrasion resistance. medium. For parts requiring high electrical conductivity plus high strength, such as welding wheels, welding tips, bushings, circuit breaker contact parts, etc.

No. 70; Be 0.15; Cr 0.5, balance Cu. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, wire, sheet and plate. Heat-treated; ts, 65-75,000 psi; ys, 35-45,000 psi; elong in 2 in., 15-20%; hardness, Rockwell B, 70-75; nonmagnetic; weldability, good; abrasion resistance, medium; max cont serv temp, 750 F; resists corrosion by atmosphere and salt water. For parts requiring high electrical conductivity plus high strength, such as welding wheels, electrode tips, bushings, etc.

No. 165; low-cost, general purpose alloy combining good formability with high physical properties. Available in heat-treatable or mill-hardened condition in strip, wire and rod form. Meets ASTM Spec. B 194-46T. For springs and formed parts requiring spring properties.

BESCOLOY (Alloy steel castings)—Brighton

Electric Steel Castings Co., Beaver Falls, Pa.

Alloy steel; Ni 3, Cr 2; furnished in sand castings to specification. Heat treated, Bhn is 340; magnetic; weldability, good.

BETHADUR (Stainless steels)—Bethlehem Steel Co., Bethlehem, Pa.

In bars and billets covering the entire range of AISI standard grades except free-machining. For type, property and characteristics data, see "Stainless Steels" listing at end of this section.

BETHALON (Free-machining stainless steels)—Bethlehem Steel Co., Bethlehem, Pa.

In bars and billets. For type, property and characteristics data, see "Stainless Steels" listing at end of this section.

BETHANIZED (Zinc-coated steel wire)—Bethlehem Steel Co., Bethlehem, Pa.

BETHCOLITE (Tin plate)—Bethlehem Steel Co., Bethlehem, Pa.

Cold-reduced tin plate, hot-dip and electrolytic coatings.

BETH-CO-WELD (Butt-welded steel pipe)—Bethlehem Steel Co., Bethlehem, Pa.

BETH-CU-LOY (Copper-steel sheets)—Bethlehem Steel Co., Bethlehem, Pa.

Contain 0.20 min copper, plain and galvanized.

BETHLEHEM (Steels and steel products)—Bethlehem Steel Co., Bethlehem, Pa.

Includes: Forgings, castings, bars and special sections, plates, flanged and dished heads, bolts, nuts, rivets and spikes, wheels and axles, frogs, switches and rails, steel sheets and strip, steel pipe, casing and tubing, tools, wire and wire products, wire rope, structural shapes, reinforcing bars, sheet and H-piles, fabricated steel construction.

In addition to the above products Bethlehem Steel Co. manufactures the following:

ALLOY STEELS; a complete line of electric furnace and open hearth steels including the entire range of AISI and SAE grades.

CARBON STEELS; all standard open hearth and bessemer carbon steels covering the complete AISI and SAE range.

CIRCULAR STEEL BLANKS; forged and rolled for the manufacture of gears, crane wheels, sheave wheels, flywheels, turbine rotors, tire molds and rings, brake wheels and drums, and other similar products.

STAINLESS STEELS; bars and billets in grades covering the entire range of AISI stainless steels. For type, property and characteristics data, see "Stainless Steels" listing at end of this section.

TOOL STEELS; a complete range of carbon, low-alloy and high-alloy steels including carbon and carbon-vanadium tool and die steels, oil and air-hardening tool and die steels, shock-resisting steels, high-speed steels, hot-work steels, and special-purpose tool steels.

BETHTELDUCTOR (High-tensile steel wire)—Bethlehem Steel Co., Bethlehem, Pa.

Electrolytic zinc coated. Used for telephone and telegraph lines.

BIAD (Powder metals)—Biad Powder Metallurgy Co., Pittsburgh 6, Pa.

108; furnished as pressed and sintered parts to specifications. Coercive force, Hc, in oersted, 180; residual induction, Br, in gauss, 8,000; hardness, Rockwell C, 50; sp gr, 7.78. Permanent magnet, low cost, replaces 17% cobalt steel. For parts in thermostats, meters and instruments.

101; pure copper powder metal parts furnished pressed and sintered to specifications. With density of 0.299 lb per cu in.; ts, 25,000 psi; ys, 18,000 psi; hardness, Rockwell H, 45; sp gr, 8.2 with density of 0.322 lb per cu in., ts, 30,000 psi; ys, 22,000 psi; hardness, Rockwell H, 55; sp gr, 8.9. Latter material has 96% electrical conductivity. For shading coils and other electrical parts.

103; pure iron powder parts furnished pressed and sintered to specifications. Ts, 35,000 psi; ys, 20,000 psi; hardness, Rockwell H, 50; sp gr, 6.90; magnetic. For low cost machine parts.

104; contains 0.80 Cu, balance Fe plus 1% max imp. Furnished in pressed and sintered parts to specifications. Ts, 50,000 psi; ys, 35,000 psi; hardness Rockwell C, 18; sp gr, 6.85. For medium-strength low-cost machine parts such as cams, pawls, low-load gears, etc.

105; furnished in pressed and sintered parts to specifications. Contains Fe 80, Cu 20. Ts, 60,000 psi; ys, 45,000 psi; hardness, Rockwell H, 75; sp gr 7.00. Provides good strength at low cost.

102; furnished in pressed and sintered parts to specifications. Ts, 30,000 psi; ys, 20,000 psi; bhn, 51; sp gr, 7.72. For low-load gears, cams, pawls, etc.

106; for oil impregnated bearings to specification. Has 20% porosity; ts, 15,000 psi; ys, 8,000 psi; hardness, Rockwell H, 25; sp gr, 6.8.

107; furnished in pressed and sintered parts to specifications. One hundred per cent Fe; ts 40,000 psi; ys, 23,000 psi; hardness, Rockwell H, 60; sp gr 7.4. For electrical uses such as pole pieces.

109; supplied in pressed and sintered parts to specification. Sp gr, 7.86; coercive force, Hc, in oersted 250; residual induction, Br, in gauss 10,500; hardness Rockwell C, 50. Permanent magnet; low cost; replaces 36% cobalt steel. Used in thermostat, meters, and various instruments.

BINNEY (Heat-resisting castings)—The Binney Castings Co., Toledo 7, O.

No. 71 and No. 73: heat-resisting alloy castings; weldability, good; heat-resistant to 2000 F; abrasion resistance, high. Used for construction parts for heat-treating furnaces and all applications requiring heat-resistant castings.

BLUE ANCHOR (Drill rod) — Anchor Drawn Steel Co., Latrobe, Pa.

C 1.25, Si 0.25, Mn 0.25. Water-quenched and tempered; hardness, rockwell C, 65-67; abrasion resistance, medium; max cont. serv. temp, 300-500 F. For shafts, dowel pins, punches, dies, gages, etc.

BLUE RIDGE (Rolled patterned and wire glass)—Blue Ridge Div., Libbey-Owens-Ford Glass Co., Toledo, O.

Glass furnished in sheet form for cutting and bending into parts; abrasion resistance, high; resists corrosion caused by everything except hydrofluoric acid; heat resistant to 130-154 F; flexibility, low; dielectric str, 10 kv per mil; ts, 6500 psi; comp str, 36,000 lb per one-in. cube; moisture absorption, low; nonflammable; available in color; sp gr, 2.5; in transparent and translucent types. Used for covers and safety guards, utilizing polished wire glass, or tempered glass.

BOHNALITE (Aluminum base alloy)—Bohn Aluminum & Brass Corp., Detroit.

Light alloy of which aluminum is the base. For forged connecting rods, cast cylinder heads, crankcases, transmission cases, and parts for vacuum cleaners, washing machines, shoe machinery, etc.

BOOTH (Wool-base felt)—Booth Felt Co., Brooklyn, N. Y.

Furnished in sheets or strips for machining or stamping into parts; also precision-cut mechanical felt parts; heat resistant to 400 F; ts, 5-100 psi; available in colors in all standard NE types and grades. Used for washers, gaskets, grease seals and pads for insulating machinery or reducing vibration.

BOROD (Hard facing alloy)—Stoody Company, Whittier, Calif.

A fabricated steel rod containing irregularly shaped particles of tungsten carbide of 40-125 screen size. Hardness, 9-10 on Moh's scale. Provides maximum abrasion resistance; widely used on earth working equipment, on coal cutter bits, cane knives and for hard-facing small or thin parts. For oxy-acetylene and dc electric application.

BOUND BROOK (Bearing bronzes) — Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Bushings, bearings and washers; cast bronze inlaid with hard graphite lubricant in grooves or holes of various designs; particularly adaptable to high temperatures, severe static loads, immersion in liquids, exposure to dusts or where oils are objectionable.

Graphited bronze bearings; Cu 81-85; Sn 6.25-7.5, Pb 6-8, Zn 2-4. Ts, 30,000 psi; ys, 14 000 psi; elong in 2 in., 12%; max cont serv temp, 500 F. For oil-less bearings in all types of machines.

BRANDYWINE (Fiber) — Brandywine Fiber Products Co., Wilmington, Del.

Vulcanized fiber and phenol fiber paper-base material; furnished in sheets, tubes and rods; for machining and forming into parts. Abrasion resistance, medium; resists corrosion caused by weak acids; heat resistant to 300 F; flexibility, medium; dielectric str, 300 volts per mil; moisture absorption, medium; available in red, gray and black; shatterproof; sp gr, 1.35; translucent and opaque; machinability, good; takes high polish. For small mechanical and electrical parts.

BRASSOID (Brass bonded to zinc)—American Nickeloid Co., Peru, Ill.

Brass serves as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering, permitting drawing and forming without marring prefinish.

BRIDGEPORT (Copper and zinc alloys)—Bridgeport Brass Co., Bridgeport, Conn.

Yellow brass; Cu 65, Zn 35; also Cu 70, Zn 30; sheet, wire and seamless tubing for drawing, stamping and cold heading.

Cartridge brass; Cu 70, Zn 30. Sheet for making small arms ammunition and artillery cartridge cases.

Low brass; Cu 80, Zn 20; strip for drawing, spinning and stamping.

Rich low brass; Cu 85, Zn 15. Fine golden color; corrosion resistant. For vanity cases, inexpensive jewelry.

Free-cutting brass rod; Cu 60, Pb 3, balance Zn. For making automatic screw machine parts.

Forging rod; Cu 60, Pb 2, balance Zn.

Low brass; Cu 80, Zn 20; pale golden color. For parts requiring greater ductility and malleability than possessed by yellow brass.

Commercial bronze; Cu 90, Zn 10; bronze color for manufacturing stampings and drawn items and cold headed items, for outdoor use. Stands weathering better than yellow brass; copper sheet, rod, wire, seamless tubing for miscellaneous manufacturing.

Leaded brass alloys; contain from 0.25-0.375 Pb to facilitate machining.

Phosphor-bronze; Cu 92, Sn 8; for spring parts. Has better spring properties than lower tin content.

Phosphor-bronze; Cu 95, Sn 5. Sheet spring quality for manufacturing switch parts.

Copper sheets and tubes for fabricating.

Aluminum Bronze 712; supplied in strip form. Has excellent spring properties when cold rolled. Often replaces phosphor bronze spring metals.

Bronze welding rods in a variety of alloys for brazing iron and steel gears, frames, and other broken machine parts; for welding silicon bronze tanks.

BRIDGEPORT TUBING (Copper base tubing)—Bridgeport Brass Co., Bridgeport, Conn.

Condenser tubing; available in Admiralty metal for sea water, Cuzinal (aluminum brass) for harbor water, Muntz metal for fresh water, Duronze IV for aerated brackish water, Cupro-Nickel for most severe service and U. S. Navy requirements, and Arsenical copper for resisting corrosion better than straight copper.

Duplex tubing; for two different types of corrosion inside and outside of tubing which are too severe for a single alloy. Steel, stainless steel, aluminum outside or inside in combination with Admiralty brass, aluminum brass, copper or cupro nickel, used for oil refining, refrigeration systems, chemical plants and food processing.

Copper water tubing; for industrial applications, and for pipe lines on board ship; also for air conditioning, plumbing and heating lines.

BRONZOCHROM (Hard facing rod)—Eutectic Welding Alloys Corp., New York 13.

For hard overlaying against frictional wear on ferrous and nonferrous metals. These rods have low bonding temperature. Welds are hard and have low frictional coefficients. Can be applied in thin layers without distortion or stresses.

BUFFALO (Wire cloth)—Buffalo Wire Works Co., Inc., Buffalo.

Wire cloth for every industrial use. Screens for abrasive material, chemicals and powder in plain steel, tinned, brass, copper, bronze, Monel and stainless steel. Also galvanized-after-woven wire cloth.

BUFLOKAST (Alloy cast iron)—Buflovak Equipment Div., Blaw-Knox Co., Buffalo 11, N. Y.

Furnished as sand castings to suit specifications. Heat-treated, ts, 30-60,000 psi; Bhn, 160-300; max cont serv temp, 1500 F; abrasion resistance, medium.

BUNDYFLEX (Tubing)—Everhot Products Co., Chicago 12, Ill.

Copper fused and copper coated on both inside and out steel tubing which can be bent to any shape, hard or soft soldered, brazed or welded and used for many purposes for which ordinary copper tubing was previously required. Strong and has high resistance to vibration fatigue. Used on passenger cars and trucks as fuel lines, oil filter lines, hydraulic brake lines, etc. Also on oil burners, refrigerators, farm tractors, airplanes, etc.

BUNDYWELD (Tubing)—Bundy Tubing Co., Detroit, Mich.

Steel tubing; of SAE 1010 steel, in sizes ⅛ to ⅝ OD, in wall thicknesses from 0.020 to 0.049-in.

Monel tubing; in sizes ⅛ to ⅝-in. OD.

"L" Nickel tubing; in sizes ⅛ to ⅝-in. OD.

"A" Nickel tubing; in sizes ⅛ to ⅝-in. OD.

BUNTING (Bearing bronzes)—The Bunting Brass & Bronze Co., Toledo, O.

Precision-machine cored and solid bar stock. Over 1000 sizes of standardized fully-finished stock bearings for machinery applications. All cast in accordance with bearing bronze specification SAE 660 (QQB-691, Grade 12). Special sizes made to blueprint from SAE, AMS, ASTM, Federal, Navy and Air Corps specifications and from the company's recognized standard bronze bearing alloys, as follows:

No. 72 SAE 660; Cu 83, Sn 7, Pb 7 and Zn 3. General-purpose bearing bronze.

No. 27; Cu 80, Sn 10 and Pb 10. General-purpose bearing bronze.

No. 98, Cu 88, Sn 10 and Zn 2. Hard bronze for severe service and heavy pressures. An allowance of 1 per cent lead content improves machinability and bearing characteristics without impairing the physicals. Used in aviation engines.

No. 124; Cu 85, Sn 5, Pb 9 and Zn 1. Excellent in automotive camshaft and piston pin applications.

No. 125; Cu 75, Sn 5 and Pb 20. Good antifriction properties.

No. 164; Cu 86, Sn 11, Pb 1.5 and Ni 1.5. Gears and synchronizer rings.

No. 178; Cu 68, Sn 4 and Pb 28. Main and connecting rod applications.

No. 170; Pb 75, Sn 10 and Sb 15; babbitt metal.

No. 116; Sn 86, Cu 7 and Sb 7; genuine babbitt metal.

Cast bronze; Cu 64, Sn 4, Pb 4, Zn 8, Ni 20. Furnished as sand castings to specification. Ts, 45,000 psi; ys, 27,000 psi; elong in 2 in., 15%; Bhn, 95; nonmagnetic; is not weldable; abrasion resistance, medium. Used for bearings in contact with certain corrosive fluids and gases.

Aviation and machine tool bearings and transmission cones are sand, chilled or centrifugally cast and machined to the utmost precision dimensions and surface finishes.

BUTACITE (Thermoplastic plastics)—E. I. Du Pont de Nemours & Co., Inc., Arlington, N. J.

Polyvinyl butyral, thermoplastic; furnished in sheets and flakes for adhesive coatings and laminating. Soluble in esters, alcohols, ketones, chlorinated hydrocarbons; insoluble in aliphatic hydrocarbons; stable in dilute alkalies and slowly decomposed in dilute acids. Dielectric str, 360 volts per mil; ts, 2000 psi; moisture absorption, high; sp gr, 1.07; transparent. Used for safety glass.

BUTAPRENE (Synthetic rubber)—Firestone Tire & Rubber Co., Akron, O.

For molding, extruding, calendering and spreading. Has high abrasion resistance when properly compounded; resists corrosion caused by most acids, alkalis and salts; heat resistant to 275 F; flexibility, high; ts, up to 3500 psi; moisture absorption, low; takes color; shatterproof at temperatures above —40 F; sp gr, 0.96-1.0; translucent. For all automotive and aeronautical rubber parts requiring resistance to oils and fuels and marine and filling station pumps.

BUTYL (Synthetic rubber)—Enjay Co. Inc., New York 19.

Isobutylene-isoprene copolymer. Furnished in sheet form; has notable resistance to ozone, acids, alkalis and many fats and vegetable oils; max cont serv temp, 300 F; flexibility, high; dielectric strength (volts per mil. inst.), 600; ts, 100-3000 psi; elong, 50-900%; natural color is dark amber, but various colors can be produced by compounding; sp gr, 0.92; is translucent; hardness, 10-80 Shore Durometer A. Used for vibration dampening, electrical insulation, conveyor belting, rolls, flexible couplings, boots, air hose, steam hose, plywood forming bags, diaphragms. Major uses in automobile inner tubes where resistance to heat and passage of air are important.

B & W (Firebrick)—The Babcock & Wilcox Co., Refractories Div., New York 6.

Ceramics furnished in standard or special refractory shapes; fabricated by molding and kiln firing.

Junior Firebrick; serv. temp, 2925 F; fusion point 3173 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1600 F, 11.50; high melting point; high creep strength; and low volume change at elevated temperatures.

80 Firebrick; serv. temp, 3000 F; fusion point, 3190 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1600 F, 12.75; has high melting point, high creep strength; and low volume change at elevated temperatures.

Insulating Firebrick; furnished in various grades, ranging in serv. temp from 1600-2900; fusion points from 2700-3190 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1500 F, 1.24-3.15; cold crushing strength, 48-308 psi; modulus of rupture, 41-283 psi. All have high resistance to heat flow: are lightweight, and have low heat storage.

All are used for linings in all types of furnaces for industries such as ceramics, gas generators, chemicals, oil refining, power, steel producing and processing, etc.

B & W 5202 (Alloy cast steels)—The Babcock & Wilcox Co., New York 6, N. Y.

High carbon, alloy steel castings. In machined and final heat treated state: Ts, 200,000 psi; Bhn, 500-600. High abrasion resistance. For grinding and crushing machinery.

B & W CROLOY (Steel tubing)—The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

1¼; C 0.15 max, Cr 1-1.5, Mo 0.45-0.65, Si 0.5-1; useful to 1100 F in steam, slightly higher in oil refining; has fair creep strength where limited corrosion and oxidation resistance are required.

2; C 0.15 max, Cr 1.75-2.25, Mo 0.45-0.65, Si 0.5 max; for refinery and superheater tubes. Corrosion and heat-resistant at nominal temperatures.

2¼; C 0.15 max, Cr 2-2.25, Mo 0.9-1.1, Si 0.5 max; for refinery and superheater tubes where high creep strength is required.

3M; C 0.15 max, Cr 2.75-3.25, Mo 0.8-1, Si 0.5 max; suitable from 1000 to 1050 F in steam or to 1175 F in refinery applications; good creep properties and corrosion resistance superior to Croloy 2 or 2¼.

5; chromium molybdenum; C 0.15 max, Cr 4-6, Mo 0.45-0.65; for oil refinery service.

7; C 0.15 max, Cr 6-8, Mo 0.45-0.65; for oil refinery service where increased corrosion resistance is required.

9; C 0.15 max, Cr 8-10, Mo 0.90/1.10, 1.05/1.30, 1.20/1.50; semistainless alloy of good physical properties and corrosion resistance.

Also stainless steel tubing, seamless and/or welded furnished to AISI types. For information on types, properties and characteristics see "Stainless Steels" listing at end of this section.

BYERS GENUINE (Wrought iron)—A. M. Byers Co., Pittsburgh 30.

Two-component metals of high purity iron and iron silicate, furnished as pipe, tubing, plate, sheets, finished rods or bars and blooms or billets for forging. Recommended heat treatment; after severe fabrication, heat to about 1300-1400 F and allow to cool slowly. Ts, 40,000 psi; ys, 23,000 psi; elong in 8 in. (min), 14%; Bhn, 97-105; Rockwell B, 55-60; sp gr, 7.70; magnetic; good weldability. Resists corrosion caused by various chemical and electro-chemical reactions; abrasion resistance, high. For any part where resistance to corrosion and/or fatigue is essential.

C

CALITE (Heat-resisting cast steels)—Calorizing Co., Pittsburgh.

"A"; A Ni-Cr alloy (Ni 35, Cr 16); good creep strength; useful at temperatures up to 2000 F; bhn (as cast), 200. For hearth plates, enameling supports, chain, and general mechanical parts in furnaces. Also available in rolled bar stock.

"B-28"; Cr 25, Ni 10, Mo 1.00; for furnace parts operating at temperatures up to 1950 F. Combines great high temperature strength with freedom from embrittling tendency in service.

"B-29"; for furnace parts operating at temperatures up to 2050 F.

"N"; available in sheets, bars and castings. For parts operating at temperatures up to 2100 F, particularly parts subject to uneven heating or rapid, irregular temperature changes.

"E"; available in bars and sheets for parts subject to temperatures up to 1600 F.

"E-28"; available in bars and sheets for parts subject to temperatures up to 1950 F.

CALSTRIP (Carbon steel) — California Cold Rolled Steel Corp., Los Angeles 22.

Carbon steel of SAE 1010 analysis furnished in straight and coiled strip. For low-strength parts requiring high ductility and softness. Has good formability.

CAMBRIDGE (Flexible wire cloth)—Cambridge Wire Cloth Co., Cambridge, Md.

A flexible wire cloth used for conveyor belts in processing, mechanical, food, glass, ceramic and metalworking fields.

CARBOCELL (Porous carbon)—National Carbon Co., Inc., New York 17.

Available in a variety of standard and special elements in several pore size grades. Elements include open and blind-end tubes, rods up to 36 inches in length and 6⅝ in. in diam., plates with maximum dimensions of 12 x 12 x 1½ in., and blocks 14 x 14 x 9 in. Easily machined and fabricated into shapes; resistant to acids and alkalies; not subject to fracture and spalling from thermal shock. For use in filtration of corrosive liquids and gases and in conditions where thermal shock may be expected in chemical and process industries.

CARBOLOY (Cemented carbide) — Carboloy Company, Inc., Detroit.

A series of cemented carbides basically made from tungsten carbide and a softer cementing element such as cobalt. In certain grades, supplementary ingredients are the carbides of tantalum, titanium or other metals. Has high resistance to abrasive wear; outstanding because of its extreme hardness, compressive strength being as high as 800,000 psi. Rockwell hardness on "A" scale, 86-93. Does not rust or corrode under normal conditions. Recommended as wear-resistant inserts for machine parts subject to extreme wear such as cams, cam followers, valve stems, textile guides, spray nozzles, etc.

CARCOLOY (Alloy iron casting)—Pacific Car & Foundry Co., Renton, Wash.

Furnished as sand castings to specification; properties, as cast; ts, 55-85,000 psi; Bhn, 265-345; weldability, fair; has high damping capacity and fatigue ratio. For diesel engine crankshafts and similar reciprocating parts subject to high torsional vibration.

CARCOMETAL (Alloy steel castings)—Pacific Car & Foundry Co., Renton, Wash.

Furnished as sand castings to specification; in heat treated state; ts, 80-150,000 psi; ys, 60-140,000 psi; elong in 2 in., 15-35%; imp str (Izod), 40-70 ft-lb; Bhn, 160-450; weldability, good; max cont serv temp, 450 F; abrasion resistance, high. Principally recommended for structural castings requiring high elastic strength and fatigue properties where thin wall sections and extreme lightness are required.

CARDOLITE (Resins)—Irvington Varnish & Insulator Co., Irvington, N. J.

Derived from cashew nut shell liquid, a high molecular weight unsaturated material with phenolic characteristics. Includes brake-lining binders, friction fortifiers and types used in manufacture of electrical insulation; laminating, impregnating and sealing resins.

CARPENTER (Stainless and alloy steels)—The Carpenter Steel Co., Reading, Pa.

Stainless Steels in standard forms. For type, property and application data on these see "Stainless Steels" listing at end of this section.

Presto; C 1.05, Cr 1.4; for ball and roller bearings.

Silico-manganese steel; C 0.6, Mn 0.75, Si 2. For heavy-duty springs.

No. 5-317; chrome-nickel steel; C 0.5, Ni 1.75, Cr 1. For gears, clutches and shafts.

No. 5 Samson; C 0.5, Ni 1.25, Cr 0.6. For gears and clutches.

No. 4-408; C 0.4; Ni 3, Cr 0.75. For clutches and shafts.

No. 158; C 0.1, Ni 3.5, Cr 1.5. For case-hardened high-duty clash gears, shafts and clutch parts.

No. 2 Samson; C 0.2, Ni 1.25, Cr 0.6. For case-hardened gears, roller bearings, pneumatic tool parts, etc.

No. 4 Samson steel; C 0.4, Ni 1.25, Cr 0.6. For side links of silent chains, shafts, etc.

No. 3-547; nickel-steel; C 0.3, Ni 3.5. For heat-treated shafts, etc.

No. 2-547; case-hardening nickel-steel; C 0.2, Ni 3.5. For small parts requiring hard surface and tough core.

No. 500; C 0.1, Ni 5. For turbine blades, case-hardened gears, etc.

Chrome-vanadium 5-720; C 5, Cr 0.9, V 0.2. For leaf and coil springs, gears, shafts, etc.

No. 3-247; chrome-molybdenum-steel; C 0.3, Cr 1, Mo 0.2. For aircraft and automotive parts.

No. 436; C 0.15, Ni 1.75, Mo 0.25. For case-hardened parts.

Temperature compensator alloy; iron-nickel alloy; furnished in rough bars or billets, finished rods or bars, wire and strips for hot forging, stamping, turning, boring, etc.; permeability varies inversely as temperature. For magnetic shunts for meters, speedometers, tachometers, voltage regulators, etc.

CARRARA (Structural glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Plate glass generally chemical resistant; noninflammable; low flexibility; ts, 6500 psi; moisture absorption, low; available in black, white, ivory, gray, beige, jade, forest green, wine, orange and Rembrandt blue; sp gr at 70 F, 2.43. For work surfaces, separators, etc.

CARTRIDGE BRASS (Copper-zinc alloy)—Revere Copper & Brass Inc., New York 17.

Cu 70, Zn 30; furnished in straight and coiled strip; for hot and cold working, stamping, drawing, and arc, gas and resistance welding. In cold-worked state; ts, 76,000 psi; ys, 63,000 psi; elong in 2 in., 8%; hardness, 82 Rockwell B; sp gr, 8.53; max cont serv temp, 500 F. For drawn parts and stampings, pins, rivets, eyelets, electrical sockets, etc.

CATABOND (Bonding resin)—Catalin Corp. of America, New York.

Phenolic base, thermosetting; furnished as liquid resin for laminating and bonding; noninflammable; moisture absorption, low; fungi resistant. Used for abrasive wheels, laminated products, surface coating, impregnating and bonding.

CELANESE (Thermoplastic laminates)—Celanese Plastics Corp., New York 16.

Cellulose propionate and cellulose acetate in laminated sheets. Have good chemical resistance; Ts, 65,000 psi; produced in wide range of translucent and opaque colors; moisture absorption, medium; machinability, good. Used for housings, paneling, covers, etc.

CELCON (Ethyl cellulose plastics) — Celanese Plastics Corp., New York 16.

Thermoplastic; available in granules for injection molding and extruding. Abrasion resistance, medium; good resistance to alkalies and weak acids, wide solubility in organic solvents; max cont. serv. temp depends on use and formula; flexural str, 4000-12.000 psi (ASTM D 650-42T); dielectric str, 400-520 volts per mil (⅛-in. thickness); ts, 2700-8000 psi; comp str, 8000-20,000 psi; impact str, 5.6-11.6 ft lb (Izod); available in all colors except crystal and pale pastels; moisture absorption, low; sp gr, 1.07-1.18; machinability, good. Used for electrical insulation and parts, motor housings, etc.

CELITE (Diatomaceous silica material)—Johns-Manville, New York 16, N. Y.

Furnished in powdered, granular and brick forms; resistant to chemical corrosion; heat-resistant; noninflammable. Brick used for insulation of equipment operating at high temperatures; powder used as filter-aid for cutting fluid purification, fillers, etc.

CELL-TITE (Soft and hard rubber)—Sponge Rubber Products Co., Shelton, Conn.

Soft rubber, thermosetting; furnished in sheets, rods or tubes. Abrasion resistance, low; resists corrosion caused by acids and alkalies; flexibility, high; ts, to 150 psi; moisture absorption, very low; available in color; shatterproof; sp gr, 0.165-0.5; opaque; machinability, fair. For insulation.

Hard; thermosetting and thermoplastic; in sheets, rods or tubes and in laminated and molded (board) form. Abrasion resistance, low; resists corrosion caused by acids, alkalies; heat resistant to 285 F; flexibility, medium; ts, 100-300 psi; comp str, 100-450 psi; flexural str, 500-1500 psi; moisture absorption, low; shatterproof; sp gr, 0.08-0.50; opaque. For insulation.

CELLULAX (Shellac thermosetting material)—Continental-Diamond Fibre Co., Newark 23, Del.

Furnished in tubes, for compression rolling. Abrasion resistance, medium; resistant to oils and greases. Max. cont. serv. temp, 180 F; dielectric strength, 750 volts per mil; machinability, fair; opaque. For electrical insulation and oil resistant spacers.

CELLULOID (Cellulose-nitrate base plastics)—Celanese Plastics Corp., New York 16.

Thermoplastics; furnished in sheets, rods, tubes and films; for molding, swaging, veneering, machining or stamping into parts; available in colors, transparent, translucent and opaque. Abrasion resistance, medium; good resistance to sulphuric acid; soluble in lower alcohols, esters and ketones, insoluble in hydrocarbons. Max serv. temp depends on conditions; flexural str. 6000-15,000 psi (ASTM D 650-42T); dielectric str, 300-400 volts per mil (⅛-in. thickness); ts, 3000-11,000 psi; comp str, 20-30,000 psi; impact str, 2-6 ft lb (Izod); low moisture absorption; sp gr 1.35-1.57; machinability, good; bhn 5-11. For buttons, instrument dials, register wheels, etc.

CEL-O-GLASS (Plastic-coated wire mesh)—E. I. Du Pont de Nemours & Co., Wilmington, Del.

Transmits ultra-violet rays; corrosion-resistant; resistant to shock; translucent; flexible; light in weight. Used where an opalescent or translucent, flexible material is required.

CELORON (Thermosetting plastics)—Continental-Diamond Fibre Co., Newark 23, Del.

Phenol formaldehyde, thermosetting; furnished in sheet, rods, tubes for compression and transfer molding into parts, also molded parts and laminated forms; abrasion resistant; resistant to gasoline, kerosene, oil, grease, alcohol, acids and weak alkalies. Max cont. serv. temp, 250 F; flexural str, 21,000 psi (ASTM D-229-42); dielectric str, 220 volts per mil; ts, 11,000 psi; comp str, 40,000 psi; impact str, 3.6 ft lb (Izod); available in mottled tan and black; moisture absorption low; sp gr 1.35; opaque. Used for electrical insulation, gears, pinions, cams, bushings, pulleys, casters, clutches, filter plates, handles, housings, etc.

CENTRALINE (Wood-cellulose fiber) — Central Paper Co., Inc., Muskegon 28, Mich.

Wood-cellulose fiber, bleached or unbleached, or of specialty fiber; furnished either coated or saturated with plastic materials; in rolls or sheets, both plain and laminated of two or more thicknesses; abrasion-resistant; resists corrosion caused by atmospheric conditions; heat-resistant; flexible or stiff; low dielectric strength or as high as 500 volts per mil depending on final thickness of paper; ts, 7500-8500 psi; moisture absorption, varied; available in color; translucent or opaque. Used for coils, motors, gaskets, shims, noncorrosive separations, insulating, filtering, etc.

CENTRALLOY (Alloy iron castings)—Centrifugal Foundry Co., Muskegon, Michigan.

C 3.00-3.40, Si 1.80-2.40, Mn 0.6-1.0, S 0.12 max, P 0.12-0.30 max, Cr 0.15-0.75, Ni 0.15-1.0, Mo 0.15-0.40, Cu 0.15-1.50. Furnished as permanent-mold castings. Castings generally heat-treated before shipment. In heat-treated state, ts, 50,000 psi; Bhn, 187-300; max cont serv temp, 700 F; abrasion resistance, high. For piston rings, cylinder sleeves, etc.

CERAWARE (Ceramics)—General Ceramics & Steatite Corp., Keasbey, N. J.

Ceramic material for molding, casting, machining and extruding; abrasion resistance, high; resists corrosion except by hydrofluoric acid and caustic alkalies; flexibility, low; heat resistant to 250 F; ts, 200 psi; compressive strength 80,000 psi; moisture absorption, low; sp gr, 2.2; opaque; machinability, grinding only; used for chemical equipment generally.

CEREX (Thermoplastic plastics) — Monsanto Chemical Co., Plastics Div., Springfield, Mass.

A series of new thermoplastic compounds with ASTM heat distortion points of 212-256 F. Cerex X214 has ASTM heat distortion point of 220-230 F. Parts molded to close dimensional tolerances maintain dimension and mechanical strength during exposure at temperatures over the boiling point of water. Material may be injection molded in standard machines. Excellent acid and alkali resistance, as well as carbon tetrachloride and aliphatic hydrocarbons. Electrical loss properties, good; available in light amber, also a wide range of transparent, translucent and opaque colors. For electronic instrument parts, and any applications where high heat resistance is required.

CERROBASE (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead casting alloy which expands on cooling; melts at 255 F; ts, 6100 psi. Recommended for autoclaves, liquid seal for nitriding furnaces, electroforming, etc.

CERROBEND (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-cadmium casting alloy which expands on cooling and has the extremely low melting temperature of 160 F; ts, 6000 psi. Useful as a fusible alloy and as a filler for tube bending.

CERROLOW-117 (Low-melting-point alloy) — Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-cadmium-indium alloy furnished in cake and ingot and formed by casting. Melts at 117 F; ts, 5400 psi; Bhn, 12; weight, 0.32 lb per cu in.; shrinkage upon cooling of 0.0002-in. per in. makes it useful for proof casting. Used as fusible alloy in thermal safety devices, alarms, etc.

CERROMATRIX (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-antimony casting alloy which melts at 248 F and expands on cooling; ts, 13,000 psi. Used for locating and anchoring machine parts in cored holes.

CERROSAFE (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-cadmium alloy furnished in cake or ingot and formed by casting. Ts, 5400 psi; ys, 300 psi; Bhn, 9; weight, 0.341 lb per cu in.; is nonmagnetic. Shrinks slightly on solidification, grows in one hour to original cold-mold dimensions. Used as proof casting medium, spray coating of wood patterns and core boxes, duplicate patterns in making match plates.

CERROSEAL (Metal-to-glass solder)—Cerro de Pasco Copper Corp., New York.

Indium-tin alloy furnished in cake or ingot form; melts between 240 and 250 F. Adheres to glass and used to join glass to glass, and glass to metal for vacuum seals.

CERROTRU (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-tin alloy furnished in cake or ingot and formed by casting. Melts at 281 F; ts, 8000 psi; ys, 500 psi; Bhn, 22; weight, 0.315 lb per cu in. Expansion due to growth after casting is 0.0002-in. per in.

CHACE (Thermostatic bimetal)—W. M. Chace Co., Detroit 9.

A number of combinations including alloys of nickel-iron, nickel-iron-chromium, nickel-iron-manganese, pure nickel, brass, bronze, etc.; responsive to various temperature ranges and provide a wide range of deflection rates and electrical resistivities. For temperature control elements in controllers, recorders, indicators, etc.

No. 772; manganese alloy; Mn 72, Cu 18, and Ni 10; furnished in finished rods or bars, coiled strips and sheets; for turning, boring and stamping. Mechanical properties in untreated state; Ts, 120,000 psi; ys, 90,000 psi; elong, 12%; impact resistance, high; Bhn, 200; weight, 0.26 lb per cu in; nonmagnetic; weldability, fair; heat-resistant to 500 F. Used where low thermal conductivity, high electrical resistivity and high thermal expansion are required.

CHAMET (Bronze)—Chase Brass & Copper Co., Waterbury 91, Conn.

Type A; Cu 60, Sn 0.75, Zn 39.25. For shafting and structural and engineering uses.

Type B; Cu 62.25, Sn 0.65, Zn 37.10. For general cold heading and upsetting purposes.

CHASE (Brasses, bronzes, cupro-nickels)—Chase Brass & Copper Co., Waterbury 91, Conn.

Cupro-nickel; Cu 70, Ni 30; largely used for condenser tubes, particularly for extreme service in very corrosive waters.

Leaded commercial bronzes; Cu 89, Pb 2, Zn 9; for screw machine parts requiring good physical properties and high corrosion resistance.

Also various high and low brasses and bronzes in various forms to meet specific requirements for a variety of mechanical parts.

CHASE TELLURIUM COPPER—Chase Brass & Copper Co., Waterbury 91, Conn.

Cu 99.5, Te 0.5. Furnished in finished rods or bars and tubing for hot forging, extruding, turning, boring, etc.; corrosion resistant; resists heat to 450 F; medium abrasion resistance; ts, 32-55,000 psi; medium ductility; Bhn, untreated, 90. For electrical connections, parts for electric motors, switches, etc.

CHEMACO (Thermoplastic plastics)—Chemaco Corp., Berkeley Heights, N. J.

Cellulose acetate; thermoplastic; furnished in granules for molding and extruding. Abrasion resistance, high; resists corrosion caused by weak acids, weak alkalies and hydrocarbons; flexural str, 1500-12,000 (ASTM D 650-42T); dielectric str, 290-365 (⅛-in. thickness); ts, 3000-10,000 psi; comp str, 5000-30,000 psi; moisture absorption, medium; produced in color; sp gr, 1.27-1.37; transparent, translucent and opaque; machinability, excellent. For knobs, dials, controls, wheels, electrical insulation, shields, nameplates, washers, housings, etc.

Ethyl cellulose; thermoplastic; furnished in granules for molding and extruding. Abrasion resistance, low; resists corrosion caused by weak acids and alkalies; heat resistant to 140-220 F; flexibility, low; flexural str, 3500-12,000 psi (ASTM D-650-42T); dielectric str, 400-700 volts per mil; (⅛-in. thickness); impact str, 6-11.5 ft lb (Izod); ts, 5000-10,000 psi; comp str, 8000-20,000 psi; moisture absorption, low; produced in pastels; sp gr, 1.07-1.18; translucent; machinability, good. For knobs, controls, trim, nameplates, etc.

Polystyrene; thermoplastic; furnished in granules for molding and extruding. Abrasion resistance, high; resists corrosion caused by alkalies and weak acids; heat resistant to 150-190 F; flexural str, 8000-19,000 psi (ASTM D 650-42T); dielectric str, 3500 volts per mil (0.005-in. thick); ts 5000-9000 psi; comp str, 11,500-15 000 psi; moisture absorption, low; produced in color; sp gr, 1.054-1.056 (unpigmented); transparent, translucent and opaque. For use as knobs, dials, controls, wheels, electrical insulation, shields, etc.

CHEMIGUM (Synthetic rubber)—Goodyear Tire & Rubber Co., Akron 16, O.

Butadiene acrylonitril synthetic rubber; thermoplastic; for molding and extruding into parts. Abrasion resistance, high; resists corrosion caused by acids, alkalies and oils. Good low-temperature flexibility; ts, 3500 psi; moisture absorption, low; nonstaining. For gaskets, seals, vibration dampeners, hose, tubing and general rubber compounding.

CHLORIMET No. 3 (Ni-Cr-Mo cast alloy)—The Duriron Co., Inc., Dayton 1, O.

Ni 60, Mo 18, Cr 18, Fe 3, C 0.07. Furnished in sand castings to suit specifications. Ts, 75,000 psi; ys, 50,000 psi; elong in 2 in., 10%; Bhn, 225; nonmagnetic; weldability, good; resists most acids, particularly under oxidizing conditions.

No. 2 (Ni-Mo cast alloy)—Ni 62, Mo 32, Fe 3, C 0.10. Furnished as sand castings to specifications; ts, 80,000 psi; ys, 55,000 psi; elong in 2 in., 5%; Bhn, 250; nonmagnetic; weldability, good; resists hydrochloric acid at all concentrations and temperatures, hot sulfuric acid under reducing conditions, and wet hydrogen chloride gas.

CHROMALOID (Chromium bonded to nickel-bonded zinc) — American Nickeloid Co., Peru, Ill.

Chromium serves as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quickly removable, gum-adhered paper covering, permitting drawing and forming without marring pre-finish.

CHROMAX (Nickel-chromium steel) — Driver-Harris Co., Harrison, N. J.

A heat-resisting alloy used for carburizing containers or furnace parts; Ni 35, Cr 19, and balance Fe.

CHROMEL (Nickel base and nickel-chrome steels)—Hoskins Mfg. Co., Detroit.

Alloy 502; Ni 35, Cr 18½, balance mainly Fe; supplied as castings, or as rod, bars, and strips. For general heat-resistant applications and for mechanical and load-carrying members.

Alloy 651; pure nickel having 99+% nickel; furnished in ribbon strips and wire, for machining, stamping, drawing, bending and forming. In untreated state: Ts, 60,000 psi; sp gr, 8.86; magnetic; weldability, fair.

Alloy 667; nickel alloy of Mn 4, Si 1, Ni balance. Furnished in ribbon strip and wire, for machining, stamping, drawing, bending and forming, resistance welding and brazing. In untreated state: Ts, 75,000 psi; sp gr, 8.40; magnetic; resists corrosion caused by automotive combustion gases. Used for spark plugs and electrode wire.

Alloy 670; Cr 25, Ni 12, balance mainly Fe; supplied as castings or as rod, bars and strips. For high-temperature applications where sulphur corrosion must be withstood.

Grade A; Ni 80, Cr 20; supplied as castings or as rod, bars, wire and strip. Used for electric heating elements to 2100 F.

Grade C; Ni 60, Cr 16, balance mainly Fe. Used for electric heating elements to 1800 F; also for rheostatic purposes; supplied as castings, or as rods, bars and strip.

Grade D; Ni 35, Cr 18½, balance mainly Fe. Used for heating elements to 1600 F; available cast, or as wire, rod and strip, and welding wire. For mechanical purposes where heat resistance or load-carrying ability while hot are of importance.

CIBANITE (Plastics molding powder)—Ciba Co. Inc., New York 14.

Aniline formaldehyde resin, thermoplastic, furnished in powder form for molding. Abrasion-resistant; resists corrosion caused by alkalies; heat-resistant up to 247 F; flexibility, low; dielectric strength, 400-600 volts per mil; ts, 8200 psi; comp str, 24,000 psi; moisture absorption, 0.01-0.08 per cent; available in natural brown color; impact str, 0.30 ft lb; sp gr, 1.22-1.25; translucent; machinability, good. For use where good strength with electrical properties are required, such as for stator insulation, tube bases, coil forms, terminal boards, strips and blocks.

CIMET (Chromium-nickel steel castings) — Driver-Harris Co., Harrison, N. J.

Ni 10-12, Cr 26-28, and balance Fe. Castings for high-temperature furnace parts.

CIRCLE L (Stainless steel alloys) — Lebanon Steel Foundry, Lebanon, Pa.

A series of wear, corrosion and heat-resistant, and stainless steel alloys in casting form, used especially for chemical and general processing equipment. Properties of the various grades are as follows: (Composition gives essential elements other than iron)

A; C 0.4; Mn 0.7; ts, 85,000 psi; Bhn, 170; for steel castings.

B; C 0.25, Si 0.40, Mn 0.65; ts, 65,000; Bhn, 135; for steel castings.

No. 3; C 0.40, Cr 1.00, Mo 0.25, Mn 0.70; ts, 110,000 psi; Bhn, 200-300; for straightening dies, cams, gears, hot pressing and light forging dies.

No. 205A; C 0.3, Si 0.4, Mn 0.8, Ni 0.6, Cr 0.6, Mo 0.20; ts, 85,000 psi; Bhn, 185; for steel castings.

No. 205B; C 0.30, Si 0.4, Mn 0.8, Ni 0.6, Cr 0.6, Mo 0.2; ts, 105,000 psi; Bhn, 225; for steel castings.

No. 205C; C 0.30, Si 0.4, Mn 0.8, Ni 0.6, Cr 0.6, Mo 0.2; ts, 120,000 psi; Bhn, 260; for steel castings of high physical properties.

No. 205D; C 0.30, Si 0.4, Mn 0.8, Cr 0.6, Ni 0.6, Mo 0.2; ts, 150,000 psi; Bhn, 320; for castings of superior physical properties.

No. 206; C 0.15, Mn 0.8, Cr 0.6, Ni 0.6, Mo 0.2; for castings to be carburized.

No. 7; C 0.07, Mn 0.25, Si 0.6; ts, 48,000 psi; Bhn, 120; for electrical parts.

No. 8; C 0.15, Cr 2.75, Mo 0.4; ts, 85,000 psi; Bhn, 190; for temperatures up to 1000 F.

No. 9; C 0.20, Mn 0.65, Mo 0.5; ts, 65,000 psi; Bhn, 135; for turbines, valves and fittings.

No. 10; C 0.20, Cr 5.50, Mo 0.50; ts, 90,000 psi; Bhn, 200; for oil still parts.

No. 11; C 0.25, Cr 19.0; ts, 100,000 psi; Bhn, 200; for valves and chemical apparatus.

No. 12; C 0.10, Cr 12.0, Ni 0.50; ts, 110,000 psi; Bhn, 220; for chemical apparatus.

No. 12M; C 0.10, Cr 13.0, Se 0.25; ts, 85,000 psi; Bhn, 170; for chemical apparatus.

No. 13; C 0.25, Cr 13.0, Ni 0.50; ts, 200,000 psi; Bhn, 500; for chemical apparatus and valve trim.

No. 14; C 0.25, Cr 21.0, Cu 1.0, Ni 0.50; ts, 90,000 psi; Bhn, 200; for exhaust manifolds, boiler tube hangers.

No. 15; C 0.30, Cr 28.0, Ni 3.0; ts, 60,000 psi; Bhn, 190; for heat and corrosion resistant parts.

No. 19; C 0.15, Ni 2.75; ts, 70,000 psi; Bhn, 150; for pumps and fittings for sub-zero service.

No. 219; C 0.15, Mn 0.65, Ni 3.25, Mo 0.25; ts, 85.000 psi; Bhn, 170; for castings for sub-zero service.

No. 21; C 0.07 max, Cr 19.50, Ni 10.50, Cb 0.80; ts, 80 000 psi; Bhn, 145; for stainless and corrosion resistant parts and weldments.

No. 22; C 0.07 max, Cr 19.50, Ni 9.0; ts, 75,000 psi; Bhn, 135; for corrosion-resistant chemical and extreme low temperature equipment.

No. 22M; C 0.07 max, Cr 19.5, Ni 9.0, Se 0.25; ts, 80,000 psi; Bhn, 160; for free-machining stainless parts.

No. 22XM; C 0.07 max. Cr 19.5, Ni 9.0, Mo 2.5; ts, 82,000 psi; Bhn, 170; for highly corrosion resistant parts.

No. 30; C 0.20 max, Cr 24.5, Ni 13.5; ts, 85,000 psi; Bhn, 165; for heat and corrosion resistant parts.

No. 30XM: C 0.20 max, Cr 24.5, Ni 13.5, Mo 3; ts, 85,000 psi; Bhn, 170; for use as parts for paper mill equipment.

No. 31; C 0.25, Ni 9.0, Cr 28.0; ts, 83,000 psi; Bhn, 170; for equipment to resist severe acids and acid fumes.

No. 32; C 0.50, Ni 35.0, Cr 15.0; ts, 70,000; Bhn, 150; for heat resistant castings.

No. 33; C 0.07, Cr 19.5, Ni 23.5, also molybdenum, copper and silicon; ts, 72,000 psi; Bhn, 150; for castings for sulphuric acid service.

No. 34; C 0.07 max, Cr 20.0, Ni 30.0, also molybdenum, copper and silicon; ts, 72,000 psi; Bhn, 150; for parts resistant to H_2SO_4.

No. 41; C 0.50, Cr 17.0, Ni 66.5; ts, 75,000 psi; Bhn, 160; for heat resistant parts.

No. 46; C 0.20, Cr 25.0, Ni 20.0; ts, 70,000 psi; Bhn, 130; for heat resistant parts.

CLEARSEAL (Vinyl resin coating)—Cleaveland Laboratories & Mfg. Co. Inc., Peapack, N. J.

Vinyl resin applied to fabric and paper, also other synthetic rubbers and covers; both thermosetting and thermoplastic; in sheet and laminated form: for molding, sewing and cementing. Abrasion resistance, high (for fabric); resists corrosion caused by acids, alkalis, salts and gasoline; max. cont. serv. temp. 250F; flexibility, high (or changed as desired); moisture absorption, may be varied as required; available in any color. For machine covers, diaphragms, bellows, oil or grease retaining jackets, etc.

CLETALOY (Spot welding electrodes)—Cleveland Tungsten Inc., Cleveland.

Copper-tungsten type electrodes for spot welding. Available in four grades with high specific gravity.

CT-A; predominantly tungsten: hardness of 92-97 Rockwell B with an electrical conductivity about 38 per cent that of pure copper. In addition to spot welding, it works well as crimper die insert for finish turning edge of steel jacket to form a seal for the porcelain stem in spark plugs.

CT-65; conductivity and tungsten similar to that of CT-A grade· hardness of 84-91 Rockwell B. For welding of thin stainless steel sheets, and in the upsetting of special steel which does not forge well, this grade supplies red hot surface which can withstand high pressure of small bar during knob forming process This grade holds original hardness especially well.

CT-86; has a higher electrical conductivity than other grades with a Rockwell B hardness of 77-83. Suitable for welding nonferrous metals and for applications where low pressures are sufficient.

LN-14; silver-tungsten-base alloy for use in applications where it shows an advantage over copper possibly having some connection with the fact that silver oxide which might form on surface is a better electrical conductor than copper oxide.

CLEVE-TUNG (Molybdenum) — Cleveland Tungsten Inc., Cleveland.

Mo 99.9 plus. Furnished in rough bars or billets, finished rods and bars, wire, sheet, plate, and powder metal. In cold-worked state: ts, from 50,000 to 250,000 psi: nonmagnetic; weldability, fair; abrasion resistance, medium; max cont serv temp. 3000 F (protected atmosphere). For various electronic parts, etc.

CLEVE-TUNGSTEN (Tungsten) — Cleveland Tungsten Inc., Cleveland, O.

Tungsten rough bars or billets, finished rods and bars wire, sheet, plate, and powder metal. For power tube parts. Hardness, Rockwell C, 40-80; sp gr. 19.3· nonmagnetic; weldability, poor: resists acids and alkalies: max cont serv temp (protected atmosphere), 4500 F; abrasion resistance, high.

CLIDERITE (Thermoplastic potting material)—Ernst Bischoff Co. Inc., Plastics Div., Memphis, Tenn.

A waxy plastics material meltable at temperatures above 300 F. Available in Types 1 and 2A. Sp gr (solid, 77F), 0.97; ts, 650-1050 psi; elong at breakpoint, 4-10%; resists dilute acids and alkalies in general. Resists concentrated alkalies and some concentrated mineral acids. Readily attacked by concentrated organic acids and nitric acid. Used for sealing or insulating electrical connectors, rectifiers, batteries, etc.

COAST METALS (Hard-facing rods) — Coast Metals, Inc., Canton, Ohio.

No. 101 (No. 1 gas); tough, file-hard. Good wear and abrasion resistance. High impact, nonmagnetic. Used on brick and clay machinery, agriculture and agriculture processing equipment, steel mill applications (cold).

No. 104 (No. 4 gas); dense rod, highly resistant to abrasion. Acetylene deposits on cylindrical sections without checks. Magnetic. Rockwell C hardness, single layer, 55-60. For shafting, centerless grinder rests, cams, gauge blocks.

No. 112; hard, tough. Harder than No. 101. Rockwell C 52-57. Outstanding resistance to abrasion. Non-magnetic. For digger teeth jaw crushers, bucket lips, cement mill machinery, hammer mills, excavating equipment, sand shot blast equipment.

No. 118 (No. 18 gas); high temperature properties. Withstands constant and repeated loads at high temperature. Machinable with carbide tools. Slightly magnetic. For steam valves, hot dies, punches, pump sleeves, soaking pit tong bits.

No. 107 (No. 7 gas); soft and tough. Nonmagnetic. Limited use, including chip crusher hammers and certain other types of hammer mills.

No. 108 (No. 8 gas); excellent welding properties. Can be heat treated safely. Machinable with carbide tools. Slightly magnetic. For cold trimmers, stampings and punching. Paper stripper and tin shredding knives. Flash trimmer knives.

No. 109 (No. 9 gas); free from large carbides. Magnetic. Rockwell. single layer 45-50. For hot piercing mill shoes and high speed or finishing steel mill guides.

No. 110 (No. 10 gas); hard. Moderate high temperature properties. Nonmagnetic. Rockwell C single layer. 48-56. Large steel mill guides, hot slag handling, coke plant equipment and stripper tong bits.

No. 115 (No. 15 gas): hard, tough, excellent welding characteristics. High temperature properties. Rockwell C, single layer. 53-58. Slightly magnetic. For sprocket teeth on elevators operating at high temperature. Valve ends and cams. Mixer rolls.

No. 100X (No. X gas): forgeable, tough, magnetic. Specially developed for hot shears.

COHRLASTIC (Silicone elastomer on fiberglas)—The Connecticut Hard Rubber Co., New Haven, Conn.

Furnished in sheet and strip. Abrasion resistance, medium: chemical resistance, good except for aromatics and concentrated acids and alkalies; max cont serv temp · 70 to 300-500 F; flammable at 1000-1500 F; flexibility, high; dielectric str. 550-1100 volts per mil; moisture absorption, low; available in white, opaque: shatterproof. For resilient gaskets and tapes when heat resistance and/or high dielectric strength over the entire temperature range are required.

COLMONOY (Hard facing welding rod)—Wall-Colmonoy Corp., Detroit 3.

No. 1· Cr 7-11, B 1-2, Si 2-4 and Fe balance. Welding electrode with rockwell C hardness of 58-62: sp gr. 7.70; weldability, fair. For hard facing various parts of high manganese steel such as dipper teeth, scraper blades, etc., agricultural equipment.

No. 4: Ni 75-85 Cr 8-14, B, Fe, Si and C 8 max Cast welding rod; hardness, rockwell C 35-40: sp gr. 8.22: nonmagnetic; weldability, good; resists corrosion caused by all alkalies and acids except hydrochloric; max cont. serv. temp, 1500 F; abrasion resistance, medium.

No. 5: Ni 71 81, Cr 10-17, B, Fe, Si and C 9 max Cast welding rod: hardness, Rockwell C 45-50; sp gr. 8.14; nonmagnetic; weldability, good: resists corrosion caused by all alkalies and acids except hydrochloric· max cont. serv. temp. 1500 F; abrasion resistance high. For parts subject to wear and corrosion, but which must be hard-faced with a machinable alloy, such as sleeves, auto and diesel valves, steam valves, pump sleeves, pump plungers, etc.

No. 6; Ni 71-81, Cr 10-17, and B, Fe, Si and C 9 max. Cast welding rod (powder metal or plastic rod). Hardness, rockwell C, 56-62; sp gr, 7.80; nonmagnetic; weldability, excellent; resists corrosion caused by all alkalies and acids except hydrochloric; max cont. serv. temp, 1500 F; abrasion resistance, high. For shaft sleeves and plungers, steam valve trim, centers, centerless grinder rests, cams, gages, sprockets, seal rings, etc.

No. WCR 100; Cr 13-19, B 2.75-4, W 17-22, and Fe balance. Furnished in finished rods or bars for gas welding. Hardness, rockwell C, 65-68; sp gr, 8.40; nonmagnetic; weldability, good; abrasion resistance, high.

Sweat-on Paste; for gas welding and carbon arcing. Parts hard-faced with paste may be heat-treated without harm to overlay. Hardness, rockwell C, 68-72; sp gr, 3.30: abrasion resistance, high. For tractor grousers and sprockets, coal chutes, fan blades, sand scraper blades and other foundry equipment subject to severe wear such as dipper teeth, bucket lips, etc.

COLONIAL (Alloy steel)—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

Two types, both available in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods.

No. 14; C 1.00, Si 0.25, Mn 0.25, in heat-treated state; hardness, Rockwell C, 65-67; abrasion resistance, low.

No. 7; C 1.00, Si 0.25, Mn 0.25, and V 0.20. In heat-treated state; hardness, Rockwell C, 65-67; max cont serv temp, 300-500 F; abrasion resistance, medium; good bearing qualities.

COLONIAL (Ceramics)—The Colonial Insulator Co., Akron, O.

Ceramic base material, for molding, casting, stamping and extruding. Has high abrasion resistance; resists corrosion caused by most acids and alkalies; max cont. serv. temp, 750 F; moisture absorption, low; available in colors, opaque; machinability, poor. For electrical control parts, thread guides, etc.

COLORSTRIP (Colored strip steel)—Acme Steel Co., Chicago 8, Ill.

Strip steel, electro-galvanized or plain and coated on one or both sides with any specific color (coating may be either enamel or lacquer); furnished in coils and can be fabricated by rolling or stamping; corrosion-resistant; resists heat to 150 F; same tensile strength, elongation and hardness as standard strip steel with slight variations depending on temper and analysis of the base metal.

COLUMBIA (High tensile steel)—Columbia Steel & Shafting Co., Pittsburgh 30.

Furnished in bars. Tensile strength is high; bearing properties, good; material machines freely.

COMGO (High speed tool steel)—Braeburn Alloy Steel Corp., Braeburn, Pa.

Tool steel containing C 0.78, Cr 4.00, W 4.00, Mo 5.00, Co 12.00, V 1.40. Furnished in rough bars or billets, finished rods or bars, and fabricated into parts by machining. Recommended heat treatment· 2180 F, oil quench; 1050 F draw. Heat-treated, hardness, Rockwell C 64-66: has high abrasion resistance. For various cutting and forming tools.

COMMERCIAL (Bearing bronze)—Buckeye Brass & Mfg. Co., Cleveland.

Cored and solid bronze bars: Cu 80, Sn 10, Pb 10. For bushings, bearings, etc.

COMMERCIAL (Steel castings) — Commercial Steel Castings Co., Marion, O.

Steel castings to special specifications and to ASTM, Army or Navy, American Bureau of Shipping and Maritime Commission Specifications.

COMMONWEALTH (Steel castings) — General Steel Castings Corp., Eddystone, Pa.

Produced to specifications of ASTM, AAR, Federal, Bureau of Shipping, Navy, etc.

Also carbon low and medium alloy steel castings to proprietary specifications. For railroad devices, heavy industrial machinery, pumps, etc.

COMPAC (Shellac-base plastics)—Poinsettia Co. Inc., Pitman, N. J.

Thermoplastic; furnished in powder, granules and preforms for compression molding. Available in black, red, green, blue and yellow. Moisture absorption, medium; is opaque; machinability, poor. Has excellent molding properties.

COMPAR (Thermoplastic plastics) — Resistoflex Corp., Belleville, N. J.

Compounded, modified polyvinyl alcohol base material; furnished in sheets, rods and tubes. Abrasion resistance, high; heat resistant to 250 F; flexibility, high; ts, 2500-5200 psi; moisture absorption, medium; sp gr, 1.26; hardness, 65-100. For flexible hose connections and assemblies for low and medium pressure hydraulic systems, lubricating and fuel systems. Gaskets diaphragms and molded parts.

COMPO (Porous bronze)—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

66-H-2; oil-retaining porous bronze bearings; Cu 80, Sn 9.75, graphite 1.25. Furnished in completed parts via powder metallurgy. Impregnated with 23% of lubricant by volume. Ts, 14,700 psi; hardness, 30-70 Rockwell H. For oil-less bearings in machines.

63-H-2; Oil-retaining porous bronze bearings; Cu 89, Sn 9.75, graphite 1.25. Furnished in completed powder metal parts. Impregnated with 27% of lubricant by volume. Ts, 12,000 psi; hardness, 25-50 Rockwell H. For oil-less bearings in all types of machines.

65-R-2; porous bronze bearings and washers containing higher percentage of graphite; Cu 87, Sn 9.5, graphite 3.5. Porous structure contains to 15% oil developed particularly for antiscuffing under heavy vibrating static loads; also heavy oscillating loads. Ts, 15,000 psi; comp str, 75,000 psi.

62-F; oil-retaining porous bronze bearings; Cu 85, Sn 9.5, graphite 5.5. Furnished in completed powder metal parts. For seals, seal rings, seal thrust washers in pumps, compressors, etc.

CONDULOY (Beryllium copper) — The Brush Beryllium Co., Cleveland.

Be 0.35, Ni 1.5, Cu balance. Finished in form of rough bars or billets. Heat-treated: Ts, 85-100,000 psi; ys, 70-80,000 psi; elong in 2 in., 4-13%; hardness, 90-100 Rockwell B; nonmagnetic; weldability, fair; max cont serv temp, 700-800 F; resists corrosion about same as pure copper. For resistance welding electrodes, welding wheels, circuit breakers, etc., and brake drums.

Beryllium Copper Alloy No. 6; Be 2.5, Ni 1.1, Cu balance. Furnished in form of rough bars or billets. Heat treated; Ts, 150-180,000 psi; ys, 110-140,000 psi; elong in 2 in., 1-3%; hardness, 38-44 Rockwell C; nonmagnetic; weldability, fair; abrasion resistance, high; resists corrosion about same as pure copper; max cont serv temp, 400-500 F. For bearings, bushings, and high-strength, high-hardness parts in general.

CONPERNIK (Iron-nickel alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Ni 49.5, Fe 49.5 and Mn 0.1. Has constant permeability over limited ranges of flux variations; electromagnetic; available in strip, punchings and finished cores, continuous cold-rolled strip and hot-rolled sheets. For use wherever a high ratio of reactance to resistance is required.

CONSERVO (Rubber) — Hewitt Rubber Div., Hewitt-Robins Inc., Buffalo 5.

Rubber for hose, melting and packing. Can be furnished extruded or for molding. Abrasion resistance, high. For use wherever hose, belting or packing are required.

CONSOWELD (Thermosetting laminated plastics) —Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.

Melamine formaldehyde and phenol formaldehyde base; in laminated sheet form; max cont serv temp, 250 F; dielectric strength (volts per mil. inst.), 550 (⅛ in. thick); ts, 36,000 psi; produced in fawn, gray, blue, green, ivory, linen patterns, black. Moisture absorption, low; sp gr, 1.35-1.40; opaque; machinability, good; Bhn, 34; coefficient of thermal expansion, 2.0 x 10^{-5} inch/inch/degree C. Used for nameplates, die plates, bearings, decorative covering for working areas on benches.

CONTINENTAL (Alloy steels) — Continental Foundry & Machine Co., East Chicago, Ind.

C-1; furnished in seven grades ranging from 0.20-0.80 carbon content; plain carbon steels.

C-2; C-Mn-Ni-Mo cast steel for parts requiring special physical properties such as tractor frames, locomotive castings, power shovel castings, locomotive crane castings, and other machinery parts.

C-3; C-Mn-Mo cast steel requiring special properties such as sprockets, spindles, gears, miscellaneous castings for power shovels, locomotive cranes, locomotive wheel centers and crossheads, and other parts.

C-4; C-Mn-Mo-V cast steel for pinions, axles and spindles, and other parts subject to severe service.

C-5; C-Ni-Mo cast steel for forging machinery and hammer parts, rams and sow blocks.

C-6; C-high Cr-Mo cast steel for special abrasive qualities suitable for various types mills, crushers, etc.

C-7; C-Cr-Ni-Mo cast steel designed for machinery or other parts subjected to severe wear, strength and impact service.

C-10; C-Cr-Mo cast steel for forging dies, tools, etc. All of the above steels are heat-treated to give desired properties.

"Chrome-Molybdenum"; Cr-Mo alloyed steel rolling mill rolls for blooming, bar, billet, structural and merchant mills; also backing-up rolls for strip mills.

"Heat-Treated Alloy"; Cr-Ni-Mo rolling mill rolls for billet, blooming, merchant and bar mills.

Special; Ni-Cr alloyed steel for rolling mill rolls for use in billet, bar, structural and merchant mills where resistance to wear is prime factor.

COOPER ALLOYS (Metal alloy castings)—The Cooper Alloy Foundry Co., Hillside, N. J.

Stainless steels, pure nickel, and Monel castings to specifications. Used primarily for combatting corrosion, heat and abrasion.

COPEL (Electrical resistance alloy) — Hoskins Mfg. Co., Detroit 8.

Used mostly for electrical resistance purposes, also for heating elements to 800 F. Temperature coefficient of resistance is practically nil.

COPPERWELD (Copper-covered steel)—Copperweld Steel Co., Glassport, Pa.

Copper-covered steel in wire, strand, or rods, with copper exterior permanently welded (cast) to the steel core; resists rust and corrosion; provides adequate electrical conductivity for many electrical uses and rust-resisting high strength for many mechanical uses. In its Warren, O. plant the company produces aircraft steels, stainless steels, Nitralloy steels, bearing steels and carbon alloy tool steels.

CORDIERITE (Ceramics)—General Ceramics & Steatite Corp., Keasbey, N. J.

Furnished in sheet, rods or tubes, and plates. Abrasion resistance, low; resists acids and weak alkalies, except hydrofluoric acid. Max cont. serv. temp, 2200 F; nonflammable; transverse str, 8500 psi; moisture absorption, low; sp gr, 2.38; available in light tan, opaque. For use where high heat shock resistant ceramic material is required.

CORNING (Glasses) — Corning Glass Works, Corning, N. Y.

In general, glasses with coefficient of expansion above 50 x 10^{-7}/°C. Blown, drawn, pressed products with wide range of chemical, physical, optical, electrical and mechanical properties.

CO-RO-LITE (Phenolic base resin)—Columbian Rope Co., Auburn, N. J.

Phenolic base resin material, furnished in sheet form for molding into parts. Abrasion resistance, high; heat resistant to 350 F; flexibility, medium; ts, 11,000 psi; inflammable; can be highly polished; opaque; can be produced in color. Used for cams, gears, bobbin heads, bearings, tension and compression members, etc.

CRASFLOY (Hard iron alloy) — Continental Foundry & Machine Co., East Chicago, Ind.

Hard alloy grain iron rolling mill rolls made in four grades: mild, medium, hard and super hard for rolling hot and cold strip, sheets and plate.

CROLITE (Steatite and other ceramics)—Henry L. Crowley & Co., West Orange, N. J.

Steatite and other ceramics, suitable mainly as electrical insulation and particularly the critical insulation for high-frequency radio applications.

CROMANSIL (Arc welding electrode)—Metal & Thermit Corp., New York 5 .

For main drive shafts, automotive springs, jib crane parts, etc. Weld deposit: Ts, 77-114,000 psi; ys, 65-102,000 psi; elong in 2 in., 14-26%.

Type E-43; arc welding electrode for aluminum sheet, castings, shapes or extruded forms. Min ts, 14,000 psi; chemical analysis, Al 92.5-94, Si 4.5 to 6.

CROMONITE (Hard iron alloy)—Continental Foundry & Machine Co., East Chicago, Ind.

Hard alloy chill roll made in four grades: Mild, medium, hard and super hard for hot and cold strip rolling.

CROWLEY (Powder metal)—Henry L. Crowley & Co., West Orange, N. J.

Powder metal in parts such as bearings, filters, formed pieces, etc.

CUMBERLAND (Turned and ground mild steels) —Cumberland Steel Co., Cumberland, Md.

Turned and ground steel rods made to AISI Spec's. C 1022, C 1040 and C 1141. For precision shafting, studs, tie rods, etc.

CUNIFE (Permanent-magnet copper-nickel-iron alloy) — General Electric Co., Chemical Dept., Pittsfield, Mass.

Magnets made of wire stock in round, square or rectangular form. Wire can be flattened to make thin, narrow shapes. Wide variety of magnet designs can be obtained by forming, drawing, punching, or machining.

CUNICO (Permanent-magnet alloy) — General Electric Co., Chemical Dept., Pittsfield, Mass.

Alloy of copper, nickel and cobalt, made from rod, strip or wire stock, furnished in finished shapes, age-hardened. Malleable, ductile and machinable, permitting manufacture of small magnet screws and punching of intricate shapes.

CUPALOY (Copper-base alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

Contains chromium and silver; thermal and electrical conductivity, 80-90% of pure copper; tensile properties of steel; Bhn, 140-160. Applications include spot-welding tips, seam-welding wheels and rolls, mechanical parts carrying heavy current, etc. Licensee; A. W. Cadman Mfg. Co., Pittsburgh.

CUPRODIE (Alloy steels)—A. Finkl & Sons Co., Chicago, Ill.

A 0.50 carbon, Cr-Ni-Mo-Cu steel for die blocks, inserts and bars; furnished heat-treated to various tempers, all commercially machinable to 477 Bhn. For drop hammer dies and inserts, also forging machine dies.

CUPRO NICKEL 30% (Copper-nickel alloy)—Revere Copper & Brass Inc., New York 17.

Cu 70, Ni 30; furnished as finished rods, or bars, tubing, sheets, strips (coiled) and plates; for fabricating into parts by stamping, extruding, welding, deep drawing or cold forging. Resists heat to 700 F; abrasion resistance, medium; ts, 50-90,000 psi; ductility, high; sp gr, 8.94. For marine condenser tubes and condenser plates, cold-headed bolts, etc.

CUPRON (Copper-nickel alloys) — Wilbur B.

Driver Co., Newark, N. J.

Cu 55, Ni 45; in rough bars or billets, finished rods or bars, wire and coiled strips. In untreated state, ts, 62,000 psi; elong, hard, 2%; soft 40%; sp gr, 8.9; nonmagnetic; weldability, good; heat-resistant to 1500 F. For electrical uses.

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DAIRYWHITE (Copper-nickel alloy) — Arthur Harris & Co., Chicago 7.

Cu 67, Ni 23, balance zinc, lead and tin. For food machines, dairy machines, etc.

DEFENDER (Babbitt) — Magnolia Metal Co., Elizabeth, N. J.

Lead-base, less than 10% of tin; recommended for shock loads. Bhn, 21.8.

DELLOY METALS (Chromium-cobalt-tungsten alloys)—Delloy Metals Corp Philadelphia 24, Pa.

Cast alloys of Cr, Co, and W. Mechanical properties: Ts, 54,000 psi; comp str, 325,000 psi. For bearing applications.

No. 6; Co 43, Cr 33.4, W 19.1, C 2.7, and other alloying elements 1.8. Hardness, Rockwell C, 62-64.

No. 9; Co 47.9, Cr 31.0, W 17.2, C 2.0, and other alloying elements 1.9.

DENSEWOOD (Wood-base thermoplastic) — Densewood Corp., Elkhorn, Wis.

A wood-base, thermoplastic material to be machined into parts. Abrasion resistance, medium; heat-resistant to 350 F; flexibility, low; ts, 18,000 psi; comp str, 14,400 psi; moisture absorption, low; noninflammable; sp gr, 1.15; opaque; can be highly polished. Used for pulleys, rollers, pushbuttons, etc.

DENS-TECH (Plywood)—Technical Ply-Wood, Chicago 1.

Thermoplastic; furnished in sheet form for machining into parts. Abrasion resistance, medium; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; shatterproof; machinability, good.

DEWARD (Oil-hardening tool steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A general-purpose oil-hardening tool steel. Suitable for intricate machine parts subject to wear without much shock. Hardens with very little size change. Available in hot-rolled, annealed bar stock, forged disks and rings, cold drawn or ground bars. Wide range of sizes carried in warehouse stocks.

D-H-S (Bronze)—Koppers Co. Inc., Bartlett Hayward Div., Baltimore.

Zn 21-25, Cu 61-65, hardener (Al, Mn and Fe) 13-15; furnished in rough bars, billets, rods or bars, also as sand castings. Resists corrosion; heat-resistant to 400 F; high abrasion resistance; ts, 100-130,000 psi; comp str, 90,000 psi; elastic limit, 40,000-65,000 psi; elong in 2 in., 20-11%; nonmagnetic; Bhn, untreated, 200-240. For heavy-duty bearings, gears, guides, screws, stems, nuts, etc.

Special bronze (analysis confidential); furnished in rough bars or billets, finished bars, and as sand castings. Ts, 100-130,000 psi; comp str, 65-90,000 psi; ys, 50-75,000 psi; elong, 10-18%; impact resistance, high; Bhn, 195-240; nonmagnetic; heat resistant to 400 F; abrasion resistance, high. For slow-speed bearings, high pressure parts, etc.

DIAMITE (White iron castings) — Weatherly Foundry & Mfg. Co., Weatherly, Pa.

Low-silicon cast iron containing 4½% nickel and 1½% chromium. Furnished in the form of sand castings to specification; ts, 40,000 psi; Bhn, 600-700; weldability, fair; abrasion resistance, high. For sand pumps, cement mill parts, grinding wheel molds and abrasion resistant castings.

DIAMOND (Vulcanized fiber) — Continental-Diamond Fibre Co., Newark 23, Del.

Cellulose hydrate material, furnished in laminated sheets, rods, tubes and formed parts. Abrasion resistance, high; gasoline, kerosene, oil, grease and alcohol resistant; max cont. serv. temp, 220 F; flexural str, 13,000 psi (ASTM D-229-42); dielectric str, 150 volts per mil; ts, 8000 psi; comp str, 30,000 psi; impact str, 5.5-8.0 ft lb (Izod); produced in gray, white, black and red; moisture absorption, medium; sp gr, 1.1-1.4; opaque; bhn 15. For electrical insulation, gaskets, water seals, bobbins, handles, housings and gears.

DIE-TECH (Plywood) — Technical Ply-Woods, Chicago 1.

Thermosetting; furnished in sheet form for machining into parts. Abrasion resistance, medium; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; shatterproof; machinability, good.

DILECTO (Glass fabric)—Continental-Diamond Fibre Co., Newark 23, Del.

Phenol formaldehyde thermosetting material; furnished in sheets, rods and tubes for compression molding. Abrasion resistance, high; gasoline, kerosene, oil, grease, alcohol, acid and weak alkali-resistant. Max cont. serv. temp, 350 F; flexural str, 21,000 psi (ASTM D-229-42); dielectric str, 600 volts per mil; ts, 24,000 psi; comp str, 44,000 psi; impact str, 10.0 ft lb (Izod); produced in natural color; moisture absorption, low; sp gr, 1.6; opaque. For electrical insulation.

DILECTO (Thermosetting plastics)—Continental-Diamond Fibre Co., Newark, 23, Del.

Phenolic base, thermosetting; furnished in sheets, rods and tubes for compression molding; also available in post formed parts. Abrasion resistance, high; resistant to gasoline, kerosene, oil, grease, alcohol, acids and weak alkalies. Max cont. serv. temp. 250 F; flexural str, 19,000 psi (ASTM D-229-42); dielectric str, 700 volts per mil; moisture absorption, low; ts, 12,000 psi; available in tan and black; impact str, 1.1 ft lb (Izod); takes high polish. Used for cams, bushings, nameplates, baffle plates, thrust washers, valve seats, bobbins, pulleys and spacers.

DM (Steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

Carbon 0.15 max, Mn 0.3-0.6, Si 0.5-1, Cr 1-1.5, Mo 0.45-0.65, P 0.03 max, S 0.03 max; furnished in rough bars or billets, finished rods or bars, and tubing; for hot forging, welding, turning, boring, etc., into parts. Resists heat to 1100 F; ts, 60,000 psi min; medium ductility; fair weldability; and Bhn, annealed, 163 max. Used for oil refinery field.

DM-45 (Alloy steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

Carbon .4-.5, manganese .4-.7, silicon .5-.8, chromium 1-1.5, molybdenum .45-.65; furnished in rough bars or billets, and finished rods or bars; for hot forging, turning, boring, etc., into parts. Resists heat to 1100 deg F; ts, 150,000 psi, min, heat-treated; medium ductility; Bhn, untreated 185; heat-treated 411 max. For bolts, studs and other highly-stressed parts used at elevated temperatures.

DODGE (Composition cork)—Dodge Cork Co. Inc., Lancaster, Pa.

Furnished in sheet, strip, rods or tubes, plate and special shapes. Fabricated by die cutting, turning and sawing. Abrasion resistance, medium; noninflammable; flexibility, high; moisture absorption, medium; used for gaskets, washers, bumpers, vibration dampets, friction drives, inserts, plugs and floats.

DODGE (Steel castings) — Dodge Steel Co., Tacony, Philadelphia.

Medium-Carbon Steel (SAE 1030); furnished in heat-treated sand castings. Ts, 70,000 psi; ys, 35,000 psi; elong in 2 in., 24 per cent; bhn, 143 min; magnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 850 F. For machine parts subject to moderately high loads and impact; valves and fittings for steam, liquids and various gases; structural members, etc.

D-1 Manganese-Molybdenum Steel; furnished in heat-treated sand castings. Ts, 80-170,000 psi; ys, 55-140,000 psi; elong in 2 in., 22-7.5 per cent; bhn, 163-360; magnetic; weldability, fair (good when preheated); abrasion resistance, good (when fully hardened). For high-strength machine parts and those requiring wear resistance, and flame or induction hardening.

D-12 Low Carbon-Nickel Steel; furnished in heat treated castings. Ts, 70,000 psi; ys, 40,000 psi; bhn, 143; magnetic; weldability, good; abrasion resistance, medium; excellent low-temperature properties (15 ft-lb Charpy at 75 F). For structural and machine parts subject to impact loads, at normal and low temperatures.

DOLER ALSILOY #1 (Aluminum die-casting alloy)—Doehler-Jarvis Corp., New York.

Alloy contains 12% silicon. Ts, 38,000 psi; ys, 20,000 psi; elong in 2 in., 3%; Charpy impact, 3 ft-lb; Bhn, 75; sp gr, 2.66; nonmagnetic; resists atmospheric corrosion; max cont serv temp, 500 F; abrasion resistance, low. For general industrial parts such as for household utilities industries, optical, electrical, food containers, business machines, tools, etc.

DOLER ALSILOY #9 (Aluminum-base die-casting alloy)—Doehler-Jarvis Corp., New York.

Alloy containing Cu 4, Si 9, balance, Al. Ts, 40,000 psi; ys, 25,000 psi; elong in 2 in., 2.5%; Charpy impact, 3 ft-lb; Bhn, 80; sp gr, 2.80; nonmagnetic; weldability, fair; resists atmospheric corrosion; max cont serv temp. 500 F; abrasion resistance, low. For electrical items, household utilities, food containers.

DOLER ALSILOY #10 (Aluminum-base die-casting alloy)—Doehler-Jarvis Corp., New York.

Alloy containing Si 10, Mg 0.5, balance Al. Ts, 45,000 psi; ys, 25,000 psi; elong in 2 in., 4%; charpy impact, 5 ft-lb; Bhn, 75; sp gr, 2.66; nonmagnetic; weldability, fair; resists atmospheric corrosion; max cont serv temp, 500 F; abrasion resistance, low. For die-cast machine parts requiring good tensile strength, high corrosion resistance and good electrical properties.

DOLER-BRASS (Brass die castings)—Doehler Jarvis Corp., New York.

Brass die castings. Composition suited to meet varying conditions. Ts, to 100,000 psi, and Bhn, to 180; excellent corrosion resisting properties.

DOLER-MAG (Magnesium-base die castings)—Doehler Jarvis Corp., New York.

Die castings to specification which are one-third lighter than aluminum.

DOLER-ZINK (Zinc-base die castings)—Doehler Jarvis Corp., New York.

Zinc base die castings of maximum tensile and impact strength.

DO-LITE (Aluminum-base die castings)—Doehler Jarvis Corp., New York.

Composition suited to meet stringent requirements such as high tensile strength, impact strength, hardness, corrosion resistance, thermal conductivity and electrical conductivity.

DOW CORNING DC 996 (Electrical insulating varnish)—Dow Corning Corp., Midland, Mich.

For bonding, dipping and vacuum impregnating. Abrasion resistance, medium; good resistance to dilute acids, concentrated hydrochloric, dilute and concentrated alkalies, mineral oil and salt solutions. Max cont serv temp, 400 F; flexibility, high; dielectric str, 2500-3000 volts per mil; moisture absorption, low; available in brown; shatterproof; sp gr, 1.01-1.02; opaque. For impregnating motors, transformer coils and solenoid coils insulated with inorganic materials.

DOW CORNING DC 2103 (Silicone bonding resin)—Dow Corning Corp., Midland, Mich.

For bonding rigid inorganic laminates; furnished in fluid state. Abrasion resistance, medium; chemical resistance, excellent; max cont serv temp, 400 F; slow burning; dielectric str, 250 volts per mil; arc resistance, 260 sec; ts, 14-17,000 psi; comp str, 34-

36,000 psi; transverse str, 9-11,000 psi (tensile crosswise); flexural str, 20-30,000 psi; moisture absorption, low; produced in straw color; opaque. Has high resistance to tracking. For electric panel board, transformer tubes and electrical parts.

DOW CORNING (Silicone fluids and greases)—Dow Corning Corp., Midland, Mich.

DC 702 and DC 703 (Silicone fluid); boiling point, 750 to 840 F; flash point, 390 to 490 F; moisture absorption, low; sp gr, 1.07 to 1.09; for high vacuum diffusion pump fluids. Stable to air and moisture at operating temperatures of 175 to 225 C. Produce vacuums as high or higher than conventional organic pump fluid.

DC 200 (Silicone fluid); is chemically inert; minimum flash point, 600 F; is water repellent; sp gr, 0.96-0.97. Shows less change in viscosity with temperature than any other known fluid; low volatility, negligible vapor pressure, high oxidation resistance. For damping, hydraulic, and instrument fluids, liquid dielectrics; mold release agents; waterproof treatments.

DC 4 (Silicone paste); max cont serv temp, 390 F; flash point, over 400 F; dielectric strength (volts per mil, inst.), greater than 500; water repellent; for waterproof seals and auxiliary dielectrics in high tension ignition systems and in disconnectable junctions of high-frequency communications equipment. Also lubricates and protects rubber and synthetic insulation from electrical leakages due to moisture and from deterioration due to thermal oxidation or corona cutting.

DC 44 (Silicone greases); max cont serv temp, —40 to 350 F; moisture absorption, low; sp gr (worked penetrometer), 235-265. Are semi-inorganic oxidation resistant greases; do not form gums or sludges; low volatility; minimum bleeding. For packing permanently sealed antifriction bearings especially in motors. Lubrication of high speed antifriction bearings at elevated temperatures.

DC 41 (Silicone greases); max cont serv temp, —40 to 400 F (less than 4000 rpm); moisture absorption, low; sp gr (worked penetrometer), 280-315; are semi-inorganic oxidation resistant greases, do not form gums or sludges, low volatility; minimum bleeding. For lubricating oven machinery, pumps handling hot salts and for low-speed equipment operating at high temperatures.

DC 33 (Silicone greases); max cont serv temp, —95 to 300 F; sp gr (worked penetrometer), 280-315. These are semi-inorganic oxidation resistant greases, do not form gums or sludges; low volatility; minimum bleeding. For lubrication of antifriction bearings exposed to extremely low and high-temperature operation at speeds up to 20,000 rpm.

DOWMETAL (Magnesium alloys)—The Dow Chemical Co., Midland, Mich.

Magnesium alloy ingots, castings, wrought forms, rods, bars, sheets, shapes, extrusions, sand and die castings; also forgings, magnesium metal ingots, and magnesium metal sticks. Available in various types:

C; Al 9, Mn 0.1, Zn 2, remainder Mg; in ingots for sand castings. Ts, 40.000 psi; comp str, 60.000 psi. ys, 16.000 psi; elong, 10%; impact resistance, high; high elastic resilience; sp gr. 1.82; nonmagnetic; resists corrosion caused by caustic chromic acid, hydrofluoric atmospheres, etc. Used for reciprocating parts and housings.

FS-1; Al 3, Mn 0.3, Zn 1, remainder Mg; in rough bars or billets, finished rods or bars, tubing, sheets, coiled strips, plates; for extruding rolling drawing and pressing. Ts, 40 000 psi; ys, 30.000 psi; comp str, 50 000 psi; elong, 16%; endurance limit (completely reversed bending). 14.500 psi; sp gr 1.77; nonmagnetic; high elastic resiliency. Used for aircraft parts and other applications requiring light weight.

H; Al 6, Mn 0.2, Zn 3, remainder Mg; in ingots for sand casting. Ts. 40.000 psi; ys, 14.000 psi; comp str, 46 000 psi; elong, 12%; impact resistance, high; high elastic resilience; sp gr. 1.83; resists corrosion caused by caustic. chromic acid, hydrofluoric atmospheres, etc. Used for aircraft parts and other applications requiring light weight.

J-I; Al 6.5, Mn 0.2. Zn 1, remainder Mg; in rough bars or billets, finished rods or bars, tubing, for hot forging, extruding, rolling, drawing and pressing. Ts. 45 000 psi; ys, 32.000 psi; comp str, 69,000 psi; elong, 15%; endurance limit (completely reversed bending), 18 000 psi; sp gr, 1.8; nonmagnetic; high elastic resilience. For structural parts and fabricated housings.

M; Mn 1.5, remainder Mg; in the same form as for sand castings, hot forging, rolling, drawing and pressing. In rolled state; ts, 37,000 psi; ys, 29,000 psi, elong, 8%; impact resistance high; sp gr, 1.76; nonmagnetic; weldability, good; heat-resistant to 400 F; high elastic resiliency. For parts requiring best formability of magnesium alloys.

O-1; Al 8.5, Mn 0.2, Zn 0.5, remainder Mg; in rough bars or billets, finished rods or bars and tubing; for hot forging and extruding. In heat treated state; ts, 50,000 psi; comp str, 75,000 psi; elong, 5%; impact resistance, high; endurance limit (completely reversed bending), 16 000 psi; sp gr, 1.8; nonmagnetic, high elastic resiliency. For structural parts requiring maximum strength.

R; Al 9, Mn 0.2, Zn 0.6, remainder Mg; in ingots for die casting. Mechanical properties in untreated state; ts, 33,000 psi; ys, 22,000 psi; elong, 3%; impact resistance, high; sp gr, 1.81; abrasion resistance, medium; nonmagnetic. For housings and structural parts.

DUC-TEN (Alloy steel castings)—Electric Steel Castings Co., Speedway, Indianapolis 24, Ind.

Wide variety of alloy steel castings including castings produced to specifications of ASTM, AAR and SAE.

DUFELT (Felt laminated with Neoprene)—The Felters Co., Boston.

Available in any desired combination of thicknesses or lamination arrangements. Corrosion-resistant. Used for washers and strips for oil and grease retention where operating conditions are too severe for use of plain felt. Petroleum-resistant.

DUNKIRK EZ (Oil hardening steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A high-carbon, silicon-manganese oil-hardening steel which machines freely compared to other tool steels due to the presence of very small particles of graphitic carbon dispersed throughout the steel. Suitable for bushings, jigs, spindles, arbors, guides on grinders and straighteners and other machine parts subject to wear without severe shock or where lubrication is difficult.

DUOLITE (Laminated shatterproof window glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Has Vinyl plastics binder; furnished in flat and bent sheets. Corrosion and abrasion resistance, high: heat resistant to 180 F; flexibility, low; moisture absorption, low; nonflammable; shatterproof; transparent; highly polished. For windows which need not be optically perfect.

DUPLATE (Laminated shatter-resistant plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Laminated plate glass and vinyl plastics binder, furnished in flat and bent sheets. Corrosion and abrasion resistance high; heat-resistant to 180 F; flexibility, low; moisture absorption, low; noninflammable; shatter-resistant; transparent; highly polished. For shatter-resistant windows, including those of high optical quality.

DURALON (Furane-base plastics)—United States Stoneware Co., Akron, O.

Thermoplastic; for casting, machining, surface coating or laminating; abrasion resistance, high; resists corrosion caused by chemical or solvent action: heat resistant to 400 deg F; flexibility, medium; dielectric strength, over 5000 volts per mil; moisture absorption, low; produced in black; shatterproof with certain fillers and in certain shapes; sp gr, 1 1; opaque; machinability, good; hardness, 110 Rockwell M (depending on cure); soluble in nothing after cure, except strong oxidizing acids. For light metal stamping dies, solvent proof coatings, cast electrical insulating parts, etc.

DURALOY (Chromium steel)—The Duraloy Co., Scottdale, Pa.

Alloy CA: Cr 11-14, C 0.15 max. Furnished in sand castings, sheets, plate and centrifugally cast tubes. Fabricated by machining and welding. Used for pump parts such as valves.

Alloy CB; Cr 18-22, C 0.30 max. Furnished in sand castings, sheets, plate, and centrifugally cast tubing. Fabricated by machining, bending and forming, arc welding and gas welding. Max cont serv temp, 1450 F. Used for special valves, impellers, etc., for high temperature service in the chemicals and food processing industries.

Alloy CC; Cr 26-30, Ni 4.00 max, C 0.50 max. Furnished in sand castings, sheets, plate and centrifugally cast tubes. Fabricated by machining and welding. Max cont serv temp, 2100 F. Has high resistance to sulphur atmospheres. Used for high temperature application.

Alloys H and H2; Cr 17-28, high carbon. Furnished in sand castings. Max cont serv temp, 1450 F; abrasion resistance, high. Used for roll guides, crusher plates, glass molds and plungers, abrasive conveying systems.

Alloy CE; Cr 17-21, Ni 9-13. Furnished in sand castings, sheet, bars, and centrifugally cast tubing. Ts, heat-treated, 75,000 psi; ys, 40,000 psi; elong in 2 in. 50%; weldability, good; max cont serv temp, 1550 F. Used for pump parts, pipe and fittings, autoclaves and digesters, textile specialties, mixing kettles.

Alloy HH; Cr 23-28, Ni 9-13. Furnished in finished rods or bars, sand castings, sheet, plate, centrifugally cast tubing. Fabricated by machining, bending and forming, arc and gas welding. Ts, 70,000 psi; ys, 45.000 psi; elong in 2 in., 15%; max cont serv temp, 2100 F. Used for furnace parts, salt pots, trays for heat-treating, belt conveyors, oil still parts, radiant burner tubes.

Alloy HT; Cr 13-17, Ni 34-37. Furnished in finished rods or bars, tubing, sand castings, sheet, plate, and centrifugally cast tubing. Fabricated by machining, bending and forming, arc and gas welding. Ts, 60,000 psi; ys, 35,000 psi; elong in 2 in., 5%; max cont serv temp, 2100 F. Used for retorts, trays, carburizing equipment, furnace parts, radiant burner assemblies.

Alloy HW; Cr 15-19, Ni 64-68. Furnished in sand castings and centrifugally cast tubing. Used for retorts, muffles, carburizing trays and fixtures, cyanide pots, etc.

DURAMAL (Pearlitic malleable iron)—Webster Mfg. Inc., Tiffin, O.

Furnished in the form of sand castings to specification; ts, 70,000 psi; ys, 50 000 psi; elong in 2 in., 10%; Bhn, 180; weldability, fair; abrasion resistance, medium. For high strength conveyor chain, abrasion resistant conveyor buckets, high strength agricultural castings, etc.

DURASHIELD (Cellulose acetate plastics)—Plastic Fabricators Inc., San Francisco, Calif.

Thermoplastics; can be fabricated to any size, shape, thickness or color: can be die cut and punched. Abrasion resistance, low; resists corrosion caused by salt spray and moisture; heat-resistant to 170 F; flexibility, high; shatterproof; moisture absorption, low; transparent, translucent and opaque. For nameplates.

DURCO (Cast alloy steels)—Duriron Co., Inc., Dayton, Ohio.

Alloy steels (KA2S, KA2SMo, etc.); 18 Cr, 8 Ni. C max 0.07. and other standards as well as special analyses preferred by users. For pumps, valves, fittings, castings for corrosive service, etc.

DUREX (Powder metals) — Moraine Products Div., General Motors Corp., Dayton, Ohio.

Products of powder metallurgy in iron, bronze and other metals; self-lubricating bearings and various small parts for electric motors, instruments, aircraft, appliances automotive equipment, farm equipment, washing machines, etc.

DUREZ (Thermosetting phenolic plastics)—Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.

Molding powders; phenolic base, thermosetting; for molding into parts; corrosion-resistant; highly polished; low moisture absorption; heat resistance, 350-550 F; ts, 4000-7000 psi; available in colors; shock and abrasion resistant. Used for housings, handles, bases, knobs, electrical parts, small gears, frames, hoods, etc.

Liquid resin (No. 7421A); cast at room temperatures; compressive str, 15.000-20 000 psi; impact str .11-.15 ft lb (Izod); flexural str, 7000 9000 psi; thermosetting; can be set by baking at temperatures above 100 F.

DURICHLOR (Alloy cast steel)—Duriron Co., Inc,. Dayton, O.

Si 14.5, Mo 3, C 0.90, Mn 1, traces of P and S, balance Fe. For pumps, valves, pipe, castings for corrosive service, especially for hydrochloric acid and chloride solutions.

DURIMET (Alloy cast steels)—Duriron Co., Inc., Dayton, O.

T; Ni 22, Cr 19, Si 1, Mo 3, Cu 1, C 0.07 max, balance Fe. For pumps, valves, bolts, nuts and castings for corrosive service, especially weak sulphuric acid.

20; Ni 29, Cr 19, Si 1, Cu 3, Mo 2, C 0.07 max, balance Fe. For pumps, valves and castings only for corrosive service, especially hot, weak sulphuric acid of strengths higher than recommended for Durimet T.

DURIRON (Alloy cast steel)—Duriron Co., Inc., Dayton, O., and licensees.

Si 14.50, C 0.8, Mn 0.6, S and P traces, balance Fe. For pumps, valves, exhaust fans, mixing nozzles and castings for handling acids and other corrosive liquids and gases.

DURITE (Cast steel)—Hanford Foundry Co., San Bernardino, Calif.

High carbon, nickel, chrome, molybdenum alloy steel, furnished as sand castings. In heat-treated state: Ts, 180,000 psi; ys, 160,000 psi; elong in 2 in., 5%; Bhn, 400-425; abrasion resistance, high; wear resistance, excellent. For ball and rod mill liners, cement mixers, etc.

DURITE (Thermosetting plastics)—Durite Plastics, Inc., Philadelphia 24, Pa.

Phenol formaldehyde and phenol furfural thermosetting plastics in powder form for compression and transfer molding. Abrasion resistance, medium; offers good resistance to weak alkalies and acids; max cont serv temp, 250-450 F; flexural str (ASTM) D 48-43T, 8-11,000 psi; dielectric str (volts per mil. inst.) 175-460; ts 5000-7500 psi; comp str, 15-35,000 psi; produced in black and brown; moisture absorption low; sp gr, 1.32-1.95; opaque; machinability fair; for ignition parts, automotive parts, housings, fuse blocks, handwheels, pulleys, handles, etc.

DURODI (Alloy steel)—A. Finkl & Sons Co., Chicago 14, Ill.

A 0.50 carbon, Cr-Ni-Mo alloy steel furnished in inserts, bars and shaped pieces; heat-treated to various tempers, all commercially machinable; also annealed for hardening in oil or in air blast. For forging machine dies, inserts and mandrels and forging dies.

DURONZE ALLOYS (High-copper silicon bronzes)—Bridgeport Brass Co., Bridgeport, Conn.

High Cu-Si bronzes alloyed with elements such as Sn, Al etc. Possess high strength combined with corrosion resistance.

Duronze I; possesses excellent cold working properties; for making cold-headed bolts and screws, average 100,000 psi ts, in rod, wire and sheet form.

Duronze II; hot-rolled sheet for making range boilers automatic heaters and storage tanks by either electric-arc or oxyacetylene welding methods; cold-rolled strip used as a substitute for phosphor bronze spring metal; rod and wire used for making hot-headed bolts and screw products; supplied in sheet, rod, wire and tube forms.

Duronze III; supplied in rod form only; ts, from 85,000 to 100,000 psi; hot forgings, 90,000 psi; free-machining for making screw machine parts also for sucker rods for corrosive oil wells; 10% lighter than brass; excellent corrosion resistance. In ingot form may be used for making sand castings with ts about 70,000 psi. Used for compression fittings for oil and gas lines in airplane construction, small gears, screws, pinions, oil burner nozzles, nuts, valves and valve stems, and bonnets, etc.

Duronze IV; made into condenser tubes only; for resisting corrosion from aerated sea water mixed with fresh water and acid wastes, sewage, etc., often found in harbors. Also for hot brine solutions in salt refining.

Duronze V; wire for making difficult cold-headed parts, screws, bolts, rod, sheet. Malleable; good corrosion resistance; ts about 100,000 psi. Recommended for cold-headed bolts and outdoor use. Also tubing for hydraulic lines on aircraft.

DUTCH BOY (Babbitt metal)—National Lead Co., New York 6.

Analysis of material varies according to the bearing application.

DYNALLOY (Alloy steel)—Alan Wood Steel Co., Conshohocken, Pa.

Alloy steel furnished in sheets, strips, and plates, for stamping, welding, cold and hot forming, etc.; abrasion resistance, medium; ts, 65-80,000 psi; ductility, high; weldability, good; fatigue and impact values, high. For structures requiring high strength.

E

EASY-FLO (Welding rods)—Handy & Harman, New York 17.

Brazing alloy; flows at 1175 F; Ag 50, Cu 15.5, Zn 16.5, Cd 18. Resists corrosion due to silver content; sp gr, 9.49. For brazing ferrous and nonferrous metals, particularly dissimilar metals and Monel metal, stainless steel and other copper-nickel and chrome-nickel alloys. Has many electrical uses.

No. 3; for fabrication of large copper piping, etc.

No. 35; Ag 35, Cu 26, Zn 21, Cd 18. Furnished in coiled strip, wire and sheet. Sp gr, 9.06, nonmagnetic. For ferrous, nonferrous and dissimilar metal which can be heated to the flowing temperature of 1295 F. Starts to melt at 1125 F.

No. 45; Ag 45, Cu 15, Zn 16, Cd 24. Furnished in coiled strip, wire and sheet for brazing. In cold-worked state: Sp gr, 9.34; nonmagnetic. Used to join metals that can be heated to 1145 F. Joins ferrous, nonferrous and dissimilar metals. Flows fast and spreads rapidly.

EBROK (Bituminous plastics)—The Richardson Co., Melrose Park, Ill.

Acid-resisting bituminous plastics for specific requirements including such parts as battery containers.

ECLIPSE (Seamless flexible metal hose)—Metal Hose Div., Bendix Aviation Corp., Teterboro, N. J.

Bronze 85/15, or 3% silicon steel, aluminum, silver and various other alloys. Tubing resists corrosion caused by salt water, ammonia, steam, gases, etc. Has high ductility.

ECONOMO (Alloy steel)—Wheelock Lovejoy & Co., Inc., Cambridge, Mass.

Carbon 0.2 and 0.5 with alloy of molybdenum; free machining; for machine tool parts.

EEL-SLIP (Composite material)—Johns-Manville, New York 16.

Asbestos fiber, graphite and rubber compound; heat-resistant; high tensile strength; non-inflammable. Used for bearings, suction box covers, etc.

EIS 45 (Chrome steel)—Heppenstall Co., Pittsburgh.

Chrome steel; C 0.85, Cr 12. Furnished for hot forging into parts. Used for shear blades for shearing medium heavy material.

EIS 57 (Nickel-chrome-molybdenum steel)—Heppenstall Co., Pittsburgh.

C 0.6. For insert and hot die steel service.

ELASTI-GLASS (Thermoplastic plastics) — S. Buchsbaum & Co., Chicago 16.

Vinylidene chloride copolymers and vinyl chloride acetate copolymers, thermoplastic; furnished in sheets and rolls or film, and in extruded rods or shapes; also for compression molding and extruding into parts. Chemically resistant to almost all solvents. Has high dielectric str; available in all colors; moisture absorption, low. For diaphragms, valve seats or protective covers.

ELASTRON (Flexible plastics)—Industrial Synthetics Corp., Garwood, N. J.

Polyvinyl family; furnished glossy to smooth dull finishes for stamping, embossing and printing; available in variety of colors, transparent, translucent or opaque; exceptionally tough; flexible; light in weight; nonflammable; inert to alcohol or oil splashes, salt water proof. For bumpers for household appliances, and other industrial applications.

ELASTUF (Alloy steels)—Horace T. Potts Co., Philadelphia 34.

Type A-2; heat-treated and stress relieved special chrome-vanadium with small controlled amounts of nickel and molybdenum; hot rolled. Further heat treating after machining not recommended. Ts (up to 2 in.), 125-145,000 psi; ys, 115-135,000 psi; elong in 2 in., 18-22%; reduction of area, 52-62%. Heat-treated alloy steel with high physical properties in machinable conditions; uniform hardness and strength throughout cross-sections of all sizes; good heat and wear resistance.

Type "44"; heat-treated and stress relieved. Special analysis including chrome, nickel and molybdenum; hot rolled. Ts (up to 2 in.), 190-220,000 psi, ys, 175-200,000 psi; elong in 2 in., 10-17%; reduction of area, 40-50%. Machinable at 42-26 Rockwell C. Has high tensile properties in machinable condition.

Type JJ Soft Steel; hot-rolled; C 0.15-0.25 (an improved analysis soft steel); furnished in bars. Carburize 1650-1700 F, cool in box, reheat to 1400-1450 F., quench in water, draw to 250-500 F. In untreated state; ts, (up to 2 in.), 60-70,000 psi; ys, 35-45,000 psi; elong in 2 in., 25-35%; reduction of area, 50-60%; weldability, good. Recommended for all soft steel uses; excellent for forging, welding, bending.

Chro-moly (heat treated); heat-treated alloy steel of good tensile properties, high impact strength and shock resistance, excellent creep characteristics. Ts (up to 2 in.), 130-150,000 psi; ys, 110-125,000 psi; elong in 2 in., 18-22%; reduction in area, 50-60%. For use as axles, heavy-duty, high-temperature and high-pressure bolts, etc.

Media; Precision Finish; analysis same as AISI C-1040 and SAE 1040; furnished in finished bars (turned, ground and polished). Normalize at 1650-1700 F, cool in air, heat to 1500-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 90-105,000 psi; ys, 75-90,000 psi; elong in 2 in., 10-20%; reduction of area 35-50%; good weldability and machinability. For use where accuracy to size and straightness is needed.

Hot-Rolled; analysis same as AISI C 1045 and SAE 1045; furnished in hot-rolled bars. Normalize at 1650-1700 F, cool in air, heat to 1500-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 80-95,000 psi; ys, 45-60,000 psi; elong in 2 in., 15-25%; reduction of area, 30-45%; good weldability and machinability, and high tensile strength.

Penn; hot-rolled; approx 0.45 carbon, special analysis. Normalize at 1650-1700 F, cool in air, heat to 1525-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 100-125,000 psi; ys, 60-75,000 psi; elong in 2 in., 15-25%; reduction of area, 30-45%; weldability, good; machining qualities, good.

Cold-Finished; approx 0.45 carbon, special analysis. Normalize at 1650-1700 F, cool in air, heat to 1525-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 110-135,000 psi; ys 100-115,000 psi; elong in 2 in., 12-22%; reduction of area, 35-50%; weldability, good; same quality as Hot-Rolled with better machinability and higher tensile properties in cold-drawn sizes (up to 3 in. dia.).

Strainfree Cold-Finished; approx 0.45 carbon, special analysis. Furnished in finished bars. Normalize at 1650-1700 F, cool in air, heat to 1525-1550 F, quench in water, draw to desired hardness. Ts (up to 1 in.), 125-145,000 psi; ys, 110-125,000 psi; elong in 2 in., 10-20%; reduction of area, 30-45%; weldability, good; specially processed to give tensile properties equal to many heat-treated alloy steels. Free from warping in machining. For lead and feed screws and miscellaneous machine parts.

ELECTROMET (Alloying elements) — Electro Metallurgical Sales Corp., New York 17, N. Y.

A complete line of ferroalloys and alloying elements of various analyses.

ELECTRUNITE (Electric welded steel tubing)—Steel & Tube Division, Republic Steel Corp., Cleveland 8.

In stainless, carbon and various alloy steels. Square, rectangular, oval, or other shapes, in any size or gage where the periphery of the shape is not less than 2-1/32 in. or more than 16 in. Furnished in following analyses: SAE 1010-1035, NE-8630, X-4130 and in stainless steels types 302, 302-B, 304, 309, 316, 317, 321, 347 and 446. Used for general mechanical, structural, aircraft, conduit, boiler, condenser, heat exchanger and other pressure applications. For data on properties, characteristics and applications for stainless steels see "Stainless Steels" listing at end of this section.

ELEPHANT BRAND (Phosphor bronze) — The Phosphor Bronze Smelting Co., Philadelphia.

Sheets in rolls, slit sheet metal, tinned both sides; in various gages and tempers covering a broad range of uses.

Wire in coils for springs, flat wire in coils or lengths; tinned binding for armature work, binding wire (round), dead soft to any temper required, straightened (round), in lengths.

Rods in complete range of sizes from rounds 0.010-4¾ in., hexagons ⅛-2¼ in., and squares ¼-2¼ in. Also in many rectangular and special shapes. For parts subject to corrosion, fatigue, wear, shock and abrasion.

Castings; special alloys for bearings, gears, valves, etc. Also 214 stock bushing sizes carried in stock.

ELKALOY (Welding electrode)—P. R. Mallory & Co., Inc., Indianapolis.

A work-hardened alloy of copper, not heat-treatable, for spot and seam welding aluminum and its alloys, unpickled hot-rolled steel, terne plate, galvanized iron and other materials. A direct substitute for copper, it handles the same but is harder and lasts longer.

ELKONITE (Electrical contact materials)—P. R. Mallory & Co., Inc., Indianapolis.

Three definite classes of materials. One group based on copper and such refractory metals as tungsten, molybdenum and their carbides —combinations which produce material with good electrical conductivity and great wear-resistant qualities, for use as welding electrodes and contactors in oil immersed circuit breakers. Certain of these grades are heat treatable. The heat treatment improves electrical and physical properties.

Second group based on silver and refractory material such as tungsten, molybdenum, and their carbides, and has been developed primarily as a facing material for heavy-duty electrical contacts and contactors for air breakers.

Third group comprises basically silver in which is incorporated refractory material such as cadmium oxide or nickel. These materials are used as heavy contacts, particularly for aircraft relays, and contact facings and main contacts on heavy-duty breakers.

All three groups can be used in the form of thin facings or as inserts with copper or copper alloy backing materials, having high electrical conductivity coupled with high physical properties.

ELKONIUM (Electrical contact materials)—P. R. Mallory & Co., Inc., Indianapolis.

A series of electrical contact materials divided into the following groups: Silver, platinum, palladium and gold-base alloys. These groups are designed to cover a wide range of applications and can be supplied in a wide variety of forms.

ELVACET (Thermoplastic plastics)—E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

Thermoplastic; supplied in solid beads of low, medium and high viscosity for molding or casting, in solution (50 per cent in methanol), and as water emulsion. Soluble in common organic solvents for use as adhesive, compatible with resins, cellulose derivatives and chlorinated rubber. Used as adhesive, binding agent, also as protective coating on machine parts.

ELVANOL (Thermoplastic plastics) — E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

Polyvinyl alcohol, thermoplastic; in powder form for molding and solvent-resistant rubber substitutes, textile sizings, paper coatings, and adhesives. Highly flexible; dielectric strength, low; heat resistant to 200 F; takes color; shatterproof; sp gr, 1.21-1.31 (powder); translucent; resistant to organic solvents. Used for oil-resistant gaskets, tubes, rollers, etc., as well as protective coatings on metal parts.

ELVERITE (Special cast iron)—The Babcock & Wilcox Co., New York 6, N. Y.

Sand cast and chill cast plain and alloyed wear iron. For tube mill liners, roll heads, jaw crushers and special applications.

ENDURO (Stainless steels)—Alloy Steel Div., Republic Steel Corp., Massillon, O.

Standard stainless steels of AISI type. For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

ERMAL Z-Metal (Pearlitic-malleable iron)—Erie Malleable Iron Co., Erie, Pa.

A spheroidized pearlitic-malleable iron; for castings requiring rigidity, high-tensile strength, and abrasion resistance. Suitable for heat treatment.

ERMALITE (Alloy iron)—Erie Malleable Iron Co., Erie, Pa.

Wear-resisting alloy iron; for wearing plates, friction drums and other parts subject to high stresses or wear.

ES (Stainless steel sheets)—Eastern Stainless Steel Corp., Baltimore 3, Md.

For type, property and application data, see "Stainless Steels" listing at end of this section.

ESCO (Cast Steels)—Electric Steel Foundry Co., Portland 10, Oreg.

Stainless, manganese, carbon and low alloy steel castings to all commercial analyses.

ETHOCEL (Dow ethylcellulose plastics) — The Dow Chemical Co., Midland, Mich.

Plastic granules, thermoplastic; furnished in granular form for injection and extrusion molding; dielectric str, 1500 volts per mil on 0.01-in. thickness; ts, 7000-8500 psi; comp str, 10-12,000 psi; heat resistance, 130-150 F; high impact strength at low temperature; low moisture absorption; good dimensional stability; available in color; sp gr, .08-1.16; translucent, opaque. Used where dimensional stability is required. Also furnished in sheeting.

EUTECHROM (Welding rod)—Eutectic Welding Alloys Corp., New York 13.

Also fluxes for building up new or worn surfaces subject to abrasive wear, and/or to maintain hard and sharp cutting edges. The rods are available either bare or flux-coated for use with the oxyacetylene torch and metallic and carbon arc.

EUTECROD (Welding rod)—Eutectic Welding Alloys Corp., New York 13.

Scientifically developed welding rods which are used with special fluxes and utilize the principle of surface alloying at low heats. These welding rods can be applied with the oxyacetylene torch, oxyhydrogen torch, and induction and furnace heating.

EUTECTIC (Welding alloys)—Eutectic Welding Alloys Corp., New York 13.

Welding alloys and special fluxes of a new type that bond to the parent metal below the melting point of the latter, forming exceedingly strong bonds through surface alloying at low heats.

Scientifically developed welding rods which are used with special fluxes and utilize the principle of surface alloying at low heat. These welding rods can be applied with the oxyacetylene torch, metallic and carbon arc, and induction and furnace heating.

EUTECTOFILM (Welding rod coating)—Eutectic Welding Alloys Corp., New York 13.

A scientifically developed coating which is used on Eutectic low-temperature welding rods to enhance their welding properties and to assist in surface alloying at low heat.

EUTECTRODE (Welding electrode) — Eutectic Welding Alloys Corp., New York 13.

Scientifically developed electrodes which utilize the principle of surface alloying. These special flux-coated electrodes are for use with the metallic arc process.

EVANSTEEL (Alloy steel castings) — Chicago Steel Foundry Co., Chicago.

Ni 1-1.5, Cr 0.65-1, C varies from 0.3-0.5, sometimes carries additions of V or Mo. For castings such as passenger car knuckles, tooth bases, sprockets, gears, high pressure valves, etc. In general, for parts requiring high tensile strength plus good shock and abrasion resistance.

EVERDUR (High copper alloys)—American Brass Co., Waterbury, Conn.

Alloy No. 1010; Cu 95.8, Si 3.1, Mn 1.1. Uses include welded tanks and sewage disposal apparatus.

Alloy No. 1012; Cu 95.60, Si 3.00, Mn 1.00, Pb 0.40; made in rod only for automatic screw machine production.

Alloy No. 1014; Cu 91.00, Si 2.00, Al 7.00; made in rods only for automatic screw machine production and hot forging.

Alloy No. 1015; Cu 98.25, Si 1.5, Mn 0.25; easily fabricated by all methods including welding. Used for tubes, bolts and screws.

EXCELSIOR (Electrical resistance alloy)—Alloy Metal Wire Co., Inc., Prospect Park, Pa.

Furnished in round and flat wire and rod. Ni 45, Cu 55. Used for wire wound resistors, controllers, instruments and other equipment where exacting electrical resistance, good resistance to oxidation and ease of soldering are required.

This company also handles nickel, Grades A, D and E Monel, "R" Monel, "K" Monel, "KR" Monel, "Z" Nickel and Inconel. For property and application data on these, see listings under material name.

F

FABROIL (Fiber material)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Oil treated, furnished in gear blanks for machining. Has high impact resistance. Used for gears.

FAHRALLOY (High alloy steel)—The Fahralloy Co., Harvey, Ill.

Ni 65, Cr 5-30, Mo 0-3, C 0.07-1.00, balance Fe. Furnished as sand castings, no heat treatment required. Ts, 80,000 psi; ys, 40,000 psi; elong in 2 in., 30%; Bhn, 160-400; sp gr, approx 7.00; weldability, good; max cont serv temp, 2000 F. Used for heat treating furnaces, food machinery, ore roasters, etc.

FAHRITE (Alloy steel castings)—The Ohio Steel Foundry Co., Springfield, Ohio.

Group of heat resistant alloy steels and group of corrosion resistant alloy steels primarily of the chromium-molybdenum type. Castings produced to specification.

FAIRPRENE (Synthetic rubber-coated fabrics)—E. I. du Pont de Nemours & Co. Inc., Fabrics Div., Fairfield, Conn.

Woven fabrics of cotton, nylon, rayon, glass, asbestos or felt, fibers, etc., coated with oil-resistant synthetic rubber. Used for parts such as diaphragms, gaskets, washers, packings, shock and insulating pads, seam sealing, and similar applications in the chemical, oil and other industries.

FALLS (Wrought iron)—Falls Hollow Staybolt Co., Cuyahoga Falls, O.

C 0.016, P 0.099, Si 0.114, Mn 0.33, S 0.018; furnished in rough bars or billets for machining. In untreated state; ts, 48-52,000 psi; elong in 8 in., 30%; weldability, very good; machinability, good. For staybolts in locomotive type boilers.

FANSTEEL (Corrosion-resistant, high-strength metals)—Fansteel Metallurgical Corp., North Chicago, Ill.

Molybdenum; Mo 99.9+; in finished rods or bars, wire, sheets, strips and powder metal; for stamping, turning, boring, welding into parts. Ts, 260,000 psi; impact resistance, high; Bhn, 147; sp gr, 10.2; nonmagnetic; resists corrosion caused by most acids; heat-resistant to 3000 F in protective atmosphere; abrasion resistance, medium. Used for critical electrical parts.

Tantalum; Ta 99.9+; finished rods or bars, tubing, wire, sheets and strips; for stamping, turning, boring, welding, etc. Ts, 42-178,000 psi; impact resistance, medium; Bhn, 75-125; sp gr, 16.6; nonmagnetic; weldability, good. For corrosion-resisting parts.

Tungsten; W 99.95; furnished in rough bars or billets, finished rods or bars, wire, sheets, shapes, powder metal and ribbon; for forming, fabricating and powder metallurgy. Mechanical properties in untreated state; ts, 490,000 psi; impact resistance, high; Bhn, 290; sp gr, 19.3; magnetic; resists corrosion caused by most acids; abrasion resistance, high.

FARLITE COMPREG (Plastic-impregnated wood veneer)—Farley & Loetscher Mfg. Co., Dubuque, Iowa.

Wood veneer impregnated with thermosetting synthetic resins before compressing; available in several grades. Thicknesses to 2 in.; for machining with same tools as for cast iron. Material has good impact and corrosion-resistance; has low moisture absorption; ts, 30,000 psi; comp str, 23,000 psi; good dimensional stability; modulus of rupture in bending, 35,000 psi. Used for bearing plates, bolts, studs, propeller blades, instrument panels, mechanical spacers, etc.

FARLITE (Thermosetting plastics sheets)—Farley & Loetscher Mfg. Co., Dubuque, Iowa.

Phenolic and melamine base, thermosetting materials; for machining and stamping into parts; corrosion-resistant; highly polished; low moisture absorption; impact-resistant; available in colors; ts, 10-12,000 psi; dielectric str, to 700 volts per mil. Used for circuit barriers, panel boards, washers, terminal strips, and for parts requiring moderate chemical resistance.

Gear stock; fabric base. Furnished in blanks of desired thickness; high moisture resistance; ts, to 11,000 psi; comp str, 39,500 psi; flex str, to 20,000 psi; and dielectric str, to 700 volts per mil.

Grade FCM-81-H, melamine glass laminate; thermosetting; furnished in laminated sheet form. Abrasion resistance, high; resists weak acids, moderate caustic, all solvents; max cont serv temp, 300 F; flexural strength (ASTM D 650-42T), 32,000 psi; dielectric strength (volts per mil. inst.), 300; ts, 38,000 psi; available in the color brown; moisture absorption, 1% in 24 hr of water; sp gr, 1.96; is opaque; machinability, poor; Bhn, 50; coefficient of thermal expansion; 3 x 10^{-5} inch/inch/degree C.

FARRELL (Abrasion-resisting cast steels) — Farrell-Cheek Steel Co., Sandusky, O.

Hard Edge; alloy steel, carbon penetrated, furnished as sand castings; high abrasion resistance; high tensile strength and ductility; Bhn, heat-treated, 650-700 and higher. For crane wheels, conveyor and elevator chains, sprockets, elevator buckets, etc.

Regular Carbon; C 0.20-0.30, Si 0.30-0.45, and Mn 0.60-0.75; furnished as sand castings. In heat-treated annealed state; ts, 72,000 psi; ys, 44,000 psi; elong in 2 in., 28%; Bhn, 140; magnetic; machinability, good. For parts requiring high ductility, medium strength and good machinability.

No. 0.25 carbon steel; furnished as centrifugal castings in annealed state.

No. 0.40 carbon steel; C 0.35-0.45, Si 0.30-0.45, Mn 0.70-0.80; furnished as sand castings. In heat-treated state; ts, 115,000 psi; ys, 84,000 psi; elong in 2 in., 18%; magnetic; weldability, good; abrasion resistance, medium. For parts requiring medium-high tensile strength and good abrasion resistance.

No. 85; specially processed steel castings for resisting abrasion. In heat-treated state; ts, 111,500 psi; ys, 93,000 psi; elong in 2 in., 20%; Bhn, 235; magnetic; weldability, good; abrasion resistance, high. For parts requiring high tensile strength and ductility.

FEATHERWEIGHT (Magnesia composition) — Keasbey & Mattison Co., Ambler, Pa.

Magnesia blocks, pipe covering and cement. Combination of magnesia and asbestos in powder or molded form with exceptionally low thermal conductivity. Used as a thermal insulating material where temperature does not exceed 600 F.

FEDERAL (Bronzes)—Federal Mogul Corp., Detroit.

F1; a gear bronze suitable for heavily loaded piston pin bushings, etc.

F2; lead bronze for average bushings application.

F3; used largely as backs for babbitt-lined bearings.

F5; widely used for babbitt-lined bearing backs and for bushings where service is not severe.

F8; good casting and machining qualities.

F11; for piston pin bushings and other low speed, heavily loaded applications.

F15; has 20 per cent lead and may be used safely under adverse lubrication conditions.

F16; because of high lead content may be used where only occasional lubrication is possible.

F18; high lead alloy of good casting characteristics.

F20; a hard bronze used for gears and worm wheels where requirements are severe; also aluminum - bronze and special analysis bronzes.

F-28; for use as compressor seals in refrigerators, ventilating equipment and similar applications.

FELPRO (Fibre-rubber-cork-felt material)—Felt Products Mfg. Co., Chicago 7.

Furnished in sheets and strips and in fabricated parts. Can be stamped or extruded into parts. Used for gaskets, metallic, semimetallic, and fibrous valve and pump packings for all applications.

FELTAN (Rubberized felt)—American Felt Co., Glenville, Conn.

Microporous sheet material, also available in strip or cut parts; for stamping. Abrasion resistance, medium; chemical resistance, as required; max cont. serv. temp, 300 F; nonflammable; flexibility, high; ts, 100 psi; transverse str, 10 psi; flexural str, high; elongation, 1500 per cent; moisture absorption, high; available in red, brown, black, grey, tan and white; opaque; shatterproof; sp gr, 1.2. Nonskid surfacing material for instruments, machines and vibration mountings, filters, etc.

FELTERS (Felts)—The Felters Co., Boston.

Nonwoven felts manufactured to highest standards and in accord with SAE and other specifications. Available in piece, roll, strip, or in parts precision-cut to specific requirements. Uses include pads, bumpers, antisqueak and anti-rattle parts, filters, polishing roll covering, shaft and bearing seals and other applications. Petroleum-resistant.

FERROWELD (Welding electrode) — Lincoln Electric Co., Cleveland.

For arc-welding cast iron. Has steel base to give solid weld on cast iron of greater tensile strength than the cast iron itself. Due to low current which can be used, hardening effect usually present along the line of fusion is materially reduced.

FIBERGLAS (Glass fiber materials) — Owens-Corning Fiberglas Corp., Toledo, O.

Wool and textile; Three kinds of wool-type fibers: (1) for thermal and accoustical insulation, compressed to various densities, in form of bats, blankets, blocks, etc.; (2) for thin porous bonded mats; (3) for filter or aeration packs (coarse fibers). Two types of textile fibers—continuous filament and staple fiber—for service fabrics, chemical filtration, electrical insulation, reinforcement in laminates, plastics, etc. Basic properties; light weight, low thermal conductivity. Wool products have good sound absorption, are resistant to moisture, individual fibers are incombustible, durable, sanitary, wide temperature range (from subzero to 1000 F).

Thermal insulations include medium and high-temperature blocks, low-temperature (asphalt-enclosed) blocks, pipe insulations, metal mesh blankets, etc., for all industrial equipment applications.

Electrical insulations for magnet wire, motors, generators, transformers — varnished cloths used for high temperature cambric applications; inorganic backing and reinforcement in mica combinations; for producing electrical laminates; for high temperature electrical adhesive tape. Tapes used for binding coils and other parts to be impregnated after wrapping; various electrical applications. Electrical tying cord for binding coils in generators and armatures, in transformers and similar static applications. Braided sleevings are used for lead wires in motors and transformers and similar applications.

Industrial textiles for high temperature pipe lagging, welding curtains and chemical filter cloths.

Dust-stop air-filters; used wherever air is moved mechanically in ventilating, heating and air-conditioning systems and in forced warm air furnaces.

FIBESTOS (Cellulose acetate plastics)—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

Thermoplastic; furnished in sheet, laminated and powder forms, for molding, machining, stamping or swaging into parts; resistant to corrosion; transparent; available in colors; flexible; tough; high polish; dielectric str, 290-600 volts per mil; ts, 5500-10,000 psi. Used for safety glass, and compressible shims, couplings, gaskets, electrically insulated knobs and handles, light diffusing panels, and molded shapes of all types.

FIBRON (Plastics tape and tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Plastics tape; polyvinyl chloride, thermoplastic; heat-sealing, flame-resistant tape for insulating and protecting against abuse and corrosion of wires, cables and electrical equipment; suitable also for splicing electrical cables and for covering piping and equipment exposed to acids, alkalies, moisture, oil and grease. Dielectric str, 1000 volts per mil for tape of 0.012-in. thickness; ts, 1600 psi.

Plastics tubing, No. 5373; polyvinyl chloride, thermoplastic; furnished in rods and tubes for extruding. Abrasion resistance, high; chemical resistance, good; max cont. serv. temp, 180 F; dielectric str, 1000 volts per mil; ts, 3000 psi; available in black, green, red, white, yellow and blue; moisture absorption, low; machinability, good. For wire insulation, conduit, lug insulation, etc.

FILLEX (Arc welding electrode) — Metal & Thermit Corp., New York 5.

For machine frames and bases, diesel exhaust manifolds, hoists and other heavy weldments. Weld deposit: Ts, 62-70,000 psi; ys, 52-58,000 psi; elong in 2 in., 25-31 per cent.

FINKL (Alloy steel)—A. Finkl & Sons Co., Chicago.

CNM; Cr-Ni-Mo; C 0.40; furnished heat-treated to various tempers. For large-section forgings or forgings of irregular section not suitable for heat-treating by liquid quenching.

FS annealed; C 0.50, Cr, Ni and Mo; oil quench; for die blocks. Miscellaneous forgings subject to forging temperatures and/or abrasion.

FX; C 0.55, Cr, Ni, and Mo; furnished heat treated to various tempers, all commercially machinable. For use as drop hammer dies and blocks, forging machine dies, backing-up rolls and dipper teeth.

FIRECRETE (Castable refractory) — Johns-Manville, New York 16.

For furnace covers and bottoms, door linings, special shapes and many other types of monolithic refractory construction. Furnished in three grades; Standard Firecrete for temperatures up to 2400 F; High Temperature Firecrete up to 2800 F; and Light Weight Firecrete up to 2400 F.

FIRTHALOY (Tungsten-carbide)—Firth-Sterling Steel Co., McKeesport, Pa.

Highly developed form of sintered carbide adapted to wire drawing dies, extrusion dies and similar purposes.

FIRTHITE (Tungsten-carbide) — Firth-Sterling Steel Co., McKeesport, Pa.

Hard metal composition of sintered carbides furnished in a number of grades to form wearing surfaces or the edges of cutting tools.

FIVEPOINT DEEPHARD (Hardened steel)—Foote Bros. Gear & Machine Corp., Chicago.

Low-carbon steel parts, regardless of SAE or NE type, manufactured by the company and hardened by its Five Point Deephard process which can be applied also to castings, forgings, bars or plate steel, and results in superior wearing qualities. Company also has special alloy steel of a nickel-moly-chrome analysis, used especially to improve cores where it is otherwise impossible to obtain core hardness over 300 Brinell because of excessive bulk. Furnished complete only as gears, pinions, or machine parts.

FLEETWELD (Welding electrodes) — Lincoln Electric Co., Cleveland.

Shielded are electrodes for welding mild steel:

Type 5; for flat, vertical and overhead welding. Ts, 65-75.000 psi; impact resistance, 30-70 ft-lb (Izod); density, 7.84-7.86 grams per cc; corrosion resistance greater than mild steel. AWS Class E-6010.

Type 7; for general-purpose welding and where fit-up is not of the best; low spatter and slag loss, high burn-off rate. Physical properties as welded: ts, 70-80,000 psi; yield point, 55-66,000; ductility, approximately 17 per cent elong. in 2 in.; sp gr, 7.80. AWS Class E-6012.

Type 9; heavily coated electrode of shielded-arc type specifically for flat welding of deep groove joints. Physical properties as welded; ts, 66-74,000 psi; yield point, 55-60.000; elong 20-30 per cent in 2 in.; sp gr, 7.85-7.86; operates either with dc or ac. AWS Class E-6030.

Type 9-HT; heavily coated electrode of shielded arc type for deep-groove welding in a flat position of high tensile steels. AWS Class E-7020.

Type 11; heavily coated electrode of shielded arc type for downhand fillet welding with "Fleet-Fillet" technique. Physical properties similar to Type 9. AWS Class E-6020.

Type 35; for flat, vertical and overhead welding on both ac and dc. Physical properties similar to Type 5 electrode. AWS Class E-6011.

Type 37; for flat, vertical and overhead welding on mild steel. Especially designed for welding sheet metal. Physical properties similar to Fleetweld 7. AWS Class E-6013.

Type 47; for flat. vertical and overhead welding on mild steel where ease of operation and cleaning are essential. Properties similar to Fleetweld 7, AWS Class E-60B.

FLEXSEAL (Laminated shatterproof plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Laminated plate glass with extended Vinyl plastic edge. furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat-resistant to 180 F; flexibility, medium; moisture absorption, low; shatterproof; transparent; highly polished; flexible edge simplifies installation. For windows having nonrigid frames or windows requiring an airtight edge seal.

FLYLITE (Magnesium-base alloy) — Magnesium Div., Howard Foundry Co., Chicago.

Grade No. 8; Al 5.3-6.7, Mn 0.15 min. Zn 2.5-3.5, Si 0.3 max, Cu 0.05 max. Ni 0.005, others 0.3, Mg remainder. As cast for castings requiring moderate strength and toughness. Heat-treated; for castings requiring high strength and maximum toughness. Heat-treated and aged for castings requiring high yield strength. hardness, moderate toughness.

Grade No. 4; Al 8.3-9.7, Mn 0.1 min. Zn 1.7-2.3. Si 0.3 max, Cu 0.05 max, Ni 0.005, others 0.3. Mg remainder. Characteristics similar to Flylite No. 8. Flylite No. 4 is preferred for maximum pressure tightness.

FOLLANSBEE (Cold rolled strip steel)—Follansbee Steel Corp., Pittsburgh 22, Pa.

Carbon steel of AISI analysis furnished in straight and coiled strip.

FORMETAL (Bushings and bearings)—National Formetal Co. Inc., Cleveland 14.

Bearings. bushings, sleeves ferrules, tubes in short lengths of any metal or alloy, to specification.

FORMICA (Laminated thermosetting plastics)—Formica Insulation Co., Cincinnati.

Resinous base, thermosetting; furnished in laminated form, for machining or stamping into parts; corrosion-resistant; tensile strength is slightly less than cast iron; high dielectric strength; absorbs no oil; changes in dimensions only slightly as the result of moisture absorption. Used for insulating washers and bushings, punched parts in switches, automotive starting systems and all types of heavy-duty gears.

Grade C; phenolic laminated fabric; thermosetting; furnished in sheets and in rods or tubes; can be highly polished; corrosion-resistant to acids and salts, not alkalies; flexible in thin sections; dielectric str, 200 volts per mil in 1/16-in. thick; ts, 10.000 psi; heat resistant to 300 F. Used for silent gears.

Grade CNP-22; laminated phenol-formaldehyde; furnished in sheets, rods or tubes for machining into parts. Abrasion resistance, high; resistant to all electroplating solutions except chromic acid; max cont. serv. temp, 275 F; flexibility, low; dielectric str. 200 volts per mil; ts, 7500 psi; flex str, 12,500 psi; moisture absorption, low; shatterproof; sp gr, 1.36; opaque; available in natural (tan); machinability, fair. For chemical resistant parts such as gears and panels for electroplating equipment.

Grade CIP-11 and CBP-11; laminated phenol-formaldehyde, thermosetting materials; furnished in sheets up to 36 x 96 in.; Abrasion resistance, medium; max cont. serv. temp, 275 F; flexural str, 17,000 psi (ASTM D 650-42T); ts, 9000 psi; comp str, 36,000 psi (flat); available in olive green (CIP-11), and black (CBP-11); moisture absorption, medium; sp gr 1.36; opaque; machinability, good. A post-forming grade for bending or drawing into various shapes after pressing. Formed shapes have good rigidity and dimensional stability.

Grade FF-55; melamine formaldehyde, thermosetting; furnished in laminated sheets up to 36 x 96 in., and in rods and tubes. Abrasion resistance, medium; chemical resistance, not recommended except for use with water or very mild alkali solutions; max cont. serv. temp, 390 F; flex str. 35.000 psi (facewise) and 40.000 psi (edgewise) (ASTM D 650-42T); dielectric str, 500 volts per mil; ts, 25 000 psi; comp str, 55,000 psi (flat); impact str. 12 ft lb/in. notch (Izod); available in light brown, opaque; moisture absorption, medium. For parts requiring good arc and fire resistance together with good mechanical strength, such as electrical instrument panel boards.

Grade LN-41; laminated melamine formaldehyde, thermosetting; furnished in sheets, rods or tubes for machining. Abrasion resistance. medium; very resistant to alkaline solutions but poor resistance to acids; max cont. serv. temp. 280 F; flexibility, low; ts, 20 000 psi; dielectric str, 370 volts per mil; comp str, 44,000 psi; flexural str, 26.000 psi; moisture absorption, low; produced in ivory, opaque; sp gr. 1.5; shatterproof. For electroplating barrel parts for alkaline solutions and other electrical fabricated parts requiring electrical arc resistance.

Grade MF; aniline-formaldehyde-glass thermosetting material: furnished in rods, tubes and laminated sheets, for molding. machining or stamping into parts: corrosion-resistant; heat-resistant to 280 F; flexibility, medium: ts. 14 000 psi: comp str. 20.000 psi: dielectric str. 450 volts per mil. moisture absorption low: nonflammable: shatterproof; opaque. For low-power loss insulation, to replace glass and porcelain parts in antenna mast bases, molded insulators, spacers, washers. etc.

Grade XX; phenolic laminated paper; thermosetting: furnished in laminated form and in rods or tubes: can be highly polished; dielectric str. 500 volts per mil: ts 12 000 psi: heat resistant to 300 F: available in natural and black; low moisture absorption. Used for insulation for electrical equipment.

Grade XXXP; phenol formaldehyde thermosetting sheets; abrasion resistance. high: max cont serv temp 225 F: flexural strength (ASTM D 650-42T). 17.500 psi; dielectric strength (volts per mil inst.), 710: ts. 13.500 psi: produced in natural and black colors; moisture absorption. low: sp gr, 1.35: is opaque: machinability. fair. For punched parts in radio transmitter and receiving equipment.

Grade XXP; laminated phenolic. paper base, furnished in sheet form. Abrasion resistance. high: chemical resistance. poor; max cont serv temp, 225 F: is slow burning; flexibility. medium: dielectric strength (volts per mil. inst.) 650 in 1/16 in. thickness; ts. 8000 psi; comp str. 25 000 psi: flexural strength. 17 500 psi: moisture absorption, low: produced in natural and black colors; sp gr. 1.36 is opaque: machinability. good. For punched parts which are to be used in applications where moisture resistance is a prime requirement.

Grade XP; laminated paper base phenolic; furnished in sheet form. Abrasion resistance, high; chemical resistance, poor; max cont serv temp, 200 F; is slow burning; flexibility, high; dielectric strength (volts per mil. inst.), 700 in 1/16 in. thickness; ts. 8000 psi; comp str, 22.000 psi; flexural strength, 17,000 psi; moisture absorption, medium; available in natural, chocolate brown, and black colors; sp gr, 1.36; is opaque; machinability, fair: for punched parts to be used in electrical insulation for automotive ignition or 110-volt apparatus.

FORTICEL (Cellulose propionate plastics)—Celanese Plastics Corp., New York 16.

Thermoplastic; available in granules for injection and compression molding. Abrasion resistance. medium; wide solubility in organic solvents; max cont. serv. temp depends upon use and formula; flexural str 4800-10.000 psi (ASTM D 650-42T); dielectric str, 370-425 volts per mil (⅛-in. thickness); ts, 2800-6000 psi; impact str, .08-11.4 ft lb (Izod); available in colors; transparent, translucent and opaque; moisture absorption, low; sp gr, 1.17-1.22; machinability, good. For vacuum cleaner parts, housings, radio cabinets, etc.

FRANKITE (Alloy irons) — Frank Foundries Corp., Moline, Ill.

E-212; low-carbon electric furnace iron; pressure-resistant and long-wearing dense grain in heavy sections. For hydraulic bodies, refrigerator parts, compressor cylinders, etc. Good machinability.

E-450; Ni 14, Cr 2. Cu 6, electric furnace Ni-Resist. Has corrosion resistance, heat resistance to 1500 F; fair machinability.

E-604; Ni 4½, Cr 1½, electric furnace Ni-Hard white iron. Combats corrosion. For mixer blades, ash chutes, scrapers, etc.

E-830-N; Cr 30 Ni 3, low carbon; heat-resistant. For continuous oven kilns, cement kiln cooler parts, furnace supports, etc.

FRANKLIN (Hard vulcanized fiber)—Franklin Fibre-Lamitex Corp., Wilmington, Del.

Thermosetting; zinc-chloride treated paper; furnished in sheet, rods, tubes and screw machine parts. Abrasion resistance, high; chemical resistance, good; dielectric strength (volts per mil. inst.), 200-300; ts 5000-6500 psi; produced in red, gray, black and white colors; moisture absorption, medium; weight 0.8 lb per cu in.; is opaque; machinability, good.

FRONTIER (Bronzes)—Frontier Bronze Corp., Niagara Falls, N. Y.

40 E; in sand castings and ingot form; not heat treated: ts, 32.000 psi min; ys. 22,000 psi min; elong. 3-10%. Resists salt water corrosion; abrasion resistance, high; excellent machinability; resistant to hydrostatic pressure; resistance to shock and impact, high. For high strength parts.

No. 5 aluminum bronze; in castings; ts, 60-95,000 psi; comp str. 22-65,000; ductility, good: Bhn, untreated, 120; heat treated, 130-200. For parts where resistance to shock, fatigue and wear are essential.

No. 11 nickel bronze: good bearing qualities with positive lubrication; wear-resistant: heat-treated, ts. 60-70.000 psi; ys 38-45,000; elong, 15-20 per cent; bhn, 160.

FURETONE (Resins)—Irvington Varnish & Insulator Co., Irvington, N. J.

Synthetic resins based on furane, which are used as compounding. laminating. and bonding resins and in protective coatings of high acid and alkali resistance. Also used as the bond in molding powders. Supplied in liquid to solid states as required.

FV (Radio spaghetti)—Irvington Varnish & Insulator Co., Irvington, N. J.

Flexible lacquered tubing for electrical insulation; meets ASTM and VTA standards for grade A-2 flexible varnished tubing: resistant to aging. oil. moisture, acid vapors, weak alkalies. Obtainable in five colors.

FYBEROID (Paper-base composition)—Wilmington Fibre Specialty Co., Wilmington 99, Del.

Furnished in sheet form, for machining or stamping into parts; dielectric strength, 200-400 volts per mil; ts. 5000-8000 psi; flexible; abrasion and corrosion-resistant. Used for insulation on motors generators, automotive ignition starters, etc.

FYBR-TECH (Plywood) — Technical Ply-woods, Chicago 1.

Thermoplastic; furnished in sheet form for molding. Abrasion resistance, medium; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; high dielectric strength; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; available in gray, red, green or white fiber faces; shatterproof; machinability, good.

G

G ALLOY (Lead-base bearing alloy)—American Smelting & Refining Co., New York.

Furnished in ingots for spinning and mold casting. Resists heat to 300 F; abrasion resistance, high; ts, 10,000 psi; comp str, 15,000 psi; good bearing properties; bhn, untreated, 22. Used for bearing applications. Is being widely substituted for tin babbitts.

GARIT (Cold-molded plastics)—Garfield Mfg. Co., Garfield, N. J.

Thermosetting, corrosion resistant; dielectric strength, 50-60 volts per mil; ts, 1200 psi; heat resistance, 500 F; moisture absorption, 2%; noninflammable; comp str, 7500 psi. Used for molded insulation for electrical equipment.

GASKOFELT (Felt-rubber material) — Western Felt Works, Chicago.

Compact combination of felt with an oil-resistant rubber compound of great density and high tensile strength. Used for gasketing in connection with oil, steam, hot or cold water; temperatures up to 250 F; pressures up to 225 lb.

G-E (Silicone rubbers)—General Electric Co., Chemical Dept., Pittsfield, Mass.

These rubbers have exceptionally high heat resistance and do not adhere to or corrode metal contacting surfaces. At low temperatures they do not increase in hardness or become stiff. Type 12,600; sp gr, 1.75; hardness, durometer Shore A, 40; compression set, at 150 C, 30%; ts, 200 psi; elong, 225%. Type 12,601; sp gr, 2.04; hardness, durometer Shore A, 60; compression set, at 150 C, 45%; ts 450 psi; elong, 150%; Type 12,602; sp gr, 1.40; hardness, durometer Shore A, 70; compression set at 150 C, 35%; ts, 650 psi; elong, 110%. Type 12,603; sp gr, 1.50; hardness, durometer Shore A, 80; compression set at 150 C, 30%; ts, 500 psi; elong, 100%.

GEMFLEX (Thermoplastics plastics) — Gemloid Corp., Elmhurst, L. I., N. Y.

Vinyl chloride acetate, furnished in rods and tubes, and for molding and extruding into parts. Has excellent resistance to acids, alkalies, oils and waters. Max cont. serv. temp, 150-160 F; dielectric str, approximately 1100 volts per mil; ts, 2500 psi; moisture absorption, low; transparent, translucent and opaque; strong and tough at lower than freezing temperatures; high fatigue strength; unusual flexibility. For insulating, gasketing, etc.

GEMLITE (Acrylic thermoplastic plastics)—Gemloid Corp., Elmhurst, L. I., N. Y.

Furnished in laminated sheet, rods and tubes for injection molding; corrosion and impact-resistant; high tensile and dielectric strengths; max cont. serv. temp, 150-160 F; nonflammable; takes high polish; transparent, opaque and translucent; available in colors; moisture absorption, low; good machinability. Used for handles, knobs, nameplates, dials, etc.

GEMLOID (Sheet plastics) — Gemloid Corp., Elmhurst, L. I., N. Y.

Thermoplastic and thermosetting material, furnished in sheet and laminated form for stamping into parts; abrasion resistance, medium; heat resistance for thermoplastics is 175 F and for thermosetting type, 400 F; ts, 4000-6000 psi; moisture absorption, low; non-flammable. Used for replacing metal nameplates.

GEMPCO (Metallic friction materials)—General Metals Powder Co., Akron, O.

Friction materials of powdered copper and other powdered metallic and nonmetallic ingredients, blended, compressed to shape and heat-treated. Riveted or brazed to metal backing. Thicknesses from 0.012-in. up. For clutch disks, clutch and brake linings.

GENERAL (Aluminum oxide)—General Ceramics & Steatite Corp., Keasbey, N. J.

Furnished in rods, tubes and plates. Abrasion resistance, high; noninflammable; transverse str, 29,000 psi; moisture absorption, low; available in white, opaque. For use where high strength for insulation is required.

GENERAL (Rubber)—The General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind.

All types of rubber, molded and extruded for household, industrial and automotive applications. For gaskets, grommets, bushings, rings, pump diaphragms, washers, casters, extruded seals, channel strips, glass-run channels, fan belts, etc.

GENESEE (Alloy steels) — Symington-Gould Corp., Rochester, N. Y.

Structural alloy steels in the following grades:

194; C 0.20, plus Mo; normalized and drawn, ts, 65,000 psi; ys, 35,000 psi; elong in 2 in., 24 per cent.

196; C 0.25, plus Mo; normalized and drawn, ts, 70,000 psi; ys, 45,000 psi; elong in 2 in., 22 per cent.

197; C 0.25, plus Mo and Cr; normalized and drawn, ts, 70,000 psi; ys, 45,000 psi; elong in 2 in., 22 per cent.

180; C 0.30, plus Mn; normalized and drawn, ts, 80,000 psi; ys, 40,000 psi; elong in 2 in., 18 per cent; bhn, 160.

185; C 0.27, plus Mn and Mo; normalized and drawn, ts, 85,000 psi; ys, 53,000 psi; elong in 2 in., 22 per cent; bhn, 170.

195; C 0.27, plus Mn, Cr and Mo; normalized and drawn, ts, 100,000 psi; ys, 70,000 psi; elong in 2 in., 18 per cent.

Also corrosion-resistant alloys, as follows:

501; C 0.20, plus Cr and Mo; normalized and drawn, ts, 105,000 psi; bhn, 210; max cont. serv. temp, 1100 F. Resistant to oxidation and creep.

420; C 0.20, plus Cr; oil-quenched and drawn, ts, 145,000 psi; bhn, 290; max cont. serv. temp, 1400 F. Resistant to wear and acids.

302; C 0.20 max, plus Cr and Ni; water-quenched, ts, 70,000 psi; bhn, 150. Resistant to tarnish and acids.

316; C 0.20 max, plus Cr, Ni and Mo; water-quenched, ts, 75,000 psi; bhn, 160. Resistant to sulphites.

312; C 0.30 plus Cr and Ni; no heat treatment required; ts, 100,000 psi; bhn, 200; max cont. serv. temp, 2000 F. Resistant to acids.

Ni Resist; C 2.75, plus Ni, Cr and Cu; ts, 25,000 psi; Bhn, 130. Resists corrosion and oxidation. (Also Cu-free grade).

Also heat-resistant alloys, as follows:

615; C 3.40 plus Cr, Mo and Si; ts, 40,000 psi; bhn, 250; max cont. serv. temp, 1300 F. For grate bars and stove parts.

303; C 0.35 plus Cr and Ni; ts, 75,000 psi; bhn, 150; max cont. serv. temp, 2100 F. For parts requiring resistance to hot gases high in sulphur.

330; C 0.35 plus Ni and Cr; ts, 70,000 psi; bhn, 140; max cont. serv. temp, 2000 F. For general high-temperature service.

15-40; C 0.35 plus Ni, Cr and Mo; ts, 60,000 psi; bhn, 120; max cont. serv. temp, 2000 F. For quenching baskets, etc.

Also abrasion-resistant alloys, as follows:

612; C 1.10 plus Mn and Cr; bhn, 200. For parts requiring impact and abrasion resistance, such as crusher plates.

Ni Hard; C 3.25, plus Ni, Cr and Si; Bhn, 550. For parts requiring abrasion and erosion resistance, such as coke chutes, etc.

GENEX (Arc welding electrode)—Metal & Thermit Corp., New York 5.

For general purpose fabrication. Weld deposit: Ts, 68-80,000 psi; ys, 53,000-65,000 psi; elong in 2 in., 17-25%.

GEON (Polyvinyl chloride, thermoplastic)—B. F. Goodrich Chemical Co., Cleveland.

Furnished in sheets and granules for injection and compression molding, extruding, calendering and solution coating. Excellent chemical resistance except for ketones and chlorinated hydrocarbons. Max cont. serv. temp, 150 F; dielectric str, 400-2000 volts per mil; ts, to 3500 psi; produced in all NEMA colors, transparent, translucent and opaque; moisture absorption, low; sp gr, 1.3. For various applications such as for electrical insulation, beverage tubing, gasket and packing material, automotive body or refrigerator strips, etc.

GIBSILOY (Powder metal)—Gibson Electric Co., Pittsburgh 21, Pa.

Electrical contact materials made by process of powder metallurgy. Several compositions available for each type of material; providing in varying degrees combinations of properties such as low and constant contact resistance, high electrical and thermal conductivity, hardness, resistance to deformation and wear, resistance to erosion from arcing and resistance to sticking.

A; silver-nickel; low contact resistance, high ductility, high current carrying capacity, hardness, cold worked, up to Rockwell B 60; in contact rivets, disks, screws, stamped or coined shapes, sheets or wire. For circuit breaker main contacts, contactors, relays, disconnect switches, instruments, slidewire contacts.

NW; silver-nickel-tungsten; combines current carrying capacity with medium current interrupting capacity; in contact disks or other stamped shapes. For contactors, switches, relays, and d-c vibrators.

C; silver-graphite; highly nonwelding, low contact resistance; in contact disks, stamped or molded shapes. For circuit breakers, and sliding contacts generally.

M; silver-molybdenum; heavy current interrupting ability, resists erosion from arcing; hardness up to Rockwell B 80; in individually molded shapes. For circuit breaker arcing tips; contactors operated under oil.

W; silver tungsten; heavy current interrupting ability, highly resistant to erosion from arcing. high conductivity; hardness up to Rockwell B 100; in individually molded shapes. Some grades for contacts in small circuit breakers such as household breakers. Other grades for heavy-duty circuit breaker arcing tips operating in air.

GLACIER (Bearing babbitt)—Glacier Metal Co., Richmond, Va.

Antifriction metal; sold in ingots; recommended pouring temperature, 600 F; Bhn, 24.1; load to reduce height of test piece by 0.001-in., 4599 psi; load required to compress test piece 50% of original height, 26,118 psi; sp gr, 9.976; wt, lb per cu in., 0.359.

Genuine Sovereign babbitt: ys, 5 tons per sq in.; elong in 2 in., 16.7%; Bhn, 28.4; load to reduce height of test piece by 0.001-in., 9800 psi; sp gr, 7.327; wt, lb per cu in. 0.263; pouring temperature, 800 F. For bearings.

GLASTIC (Thermosetting polyester plastics) — Laminated Plastics Inc., Cleveland 12.

Furnished in laminated sheets and molded shapes.

Grade S; Flex str. 40.000 psi; modulus of elasticity, 1.800 000; impact str (Izod), 12.0 ft-lb; ts, 20.000 psi; comp str, 20 000 psi; sp gr, 1.45; hardness number, 100 Rockwell M; dielectric str, 300-500 volts per mil; good resistance to acetone, moderate acids, alkalies, etc.

Grade MF; Flex str, 35,000 psi; modulus of elasticity, 1 200.000; impact str (Izod), 9.0 ft-lb; ts, 20 000 psi; comp str, 20 000 psi; sp gr, 1.45; hardness number, 100 Rockwell M; dielectric str, 300-500 volts per mil; good resistance to acetone, moderate acids, alkalies, etc.

GLOBE (Seamless steel tubing) — Globe Steel Tube Co., Milwaukee.

Carbon steel tubes in low and medium carbon for mechanical purposes. Furnished hot-finished and cold-drawn to wide range of sizes; also annealed or cold-drawn stress relieved to higher physicals for strength and machinability.

Carbon seamless steel pressure tubing in low and medium carbon for boiler, condenser, heat exchanger tubes, straight and formed.

Alloy seamless steel tubing in low and medium carbon in SAE and NE grades for mechanical and aircraft tubing; in regular and magnaflux quality. Intermediate alloys such as 5 per cent to 9 per cent Chrome Moly for petroleum industry.

Stainless seamless tubing in austenitic 18-8 types. Low carbon Type 304, stabilized Types 321 and 347 for welding and maximum corrosion and heat resistance; for dairy, food, chemical industries. Types 329 and 443 for corrosion resistance in specific applications in chemical and textile fields. Straight chrome Types 410 for heat treating where high tensile and toughness with mild corrosion resistance is required. Type 430 for chemical service, especially nitric acid; also for heat resistance applications. Type 446 for high temperature service where load carrying requirements are not severe, good resistance to high sulphur atmospheres. Used where nickel bearing grades are objectionable. For further data on properties and applications, see "Stainless Steels" listings at end of this section.

GLOBEIRON (Seamless ingot iron tubing)—Globe Steel Tube Co., Milwaukee.

High purity ingot iron in seamless tubing providing high magnetic permeability for electrical purposes. Offers some corrosion resistance in certain special cases because it approaches pure iron.

GLOWELD (Stainless steel welded tubing) — Globe Steel Tube Co., Milwaukee.

Stainless welded tubing in Types 304, 347 and 316 and special analyses for applications similar to seamless types listed elsewhere for the company. Type 316 can be used in chemical and textile fields. For property and application data, see "Stainless Steels" listing at end of this section.

GLYCO (Babbitt)—Joseph T. Ryerson & Son Inc., Chicago 80.

Turbo-Glyco; for bearings for high-speed, heavy duty; avg bhn, 30.

Marine Glyco; for bearings for electric motor and marine work; avg bhn 27.

Standard Glyco; free flowing, general purpose babbitt; avg bhn, 24.

Heavy pressure mill Glyco; high resistance to crushing loads; high bearing temperatures, avg bhn, 23.

Transmission Glyco; for line shafting and transmission work; avg bhn, 22.

GOLD ANCHOR (Drill rod) — Anchor Drawn Steel Co., Latrobe, Pa.

C 0.70, W 18, Cr 4, V 1.00, Si 0.25, Mn 0.25. Oil or air-quenched and double-tempered; hardness, rockwell C, 67 max; magnetic; weldability, poor; abrasion resistance, high; max cont. serv. temp, 1200 F. For dies, high-temperature springs, dowel pins, punches, taps, drills, reamers, dies, etc.

GRADE 609 (Shock resisting steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.60, Mn .80, Si 2.00, Cr 0.25, Mo 0.25, V 0.20. A silico-manganese shock-resisting steel for heavy duty springs, collets, press clutch parts, stressed bolts and studs, die head bodies, shafts, and other machine parts subject to shock and wear. May be hardened in oil or water.

GRAKONE (Rubber)—Graton & Knight Co., Worcester 4, Mass.

Oil-resistant rubber furnished in sheets for molding. Abrasion resistance, high; resistant to all petroleum products, vegetable oils and fats, alcohols, dilute acids and alkalies, etc. Max cont serv temp, 212 F; flexibility, high; dielectric str, at 60 cycles, 19.5 volts per mil; ts, 4000 psi max; elongation, 100 to 800; moisture absorption, low; produced in black; shatterproof; sp gr, 1.15-1.35; opaque; hardness, Shore A, 30-100. Used as sealing element for reciprocating, static or revolving shafts.

GRAMIX (Porous metals)—United States Graphite Co., Saginaw, Mich.

No. 81; sintered bronze; in porous metal bearings and mechanical shapes; ts, 15,000 psi; compressive force to cause 0.001-in. permanent set, 10,000 psi; apparent density, 6.4-6.6 grams per cu-cm; oil absorption (by volume), 20-30 per cent; coefficient of thermal expansion (70-200 F), .00000934 in. per in. per deg F.

No. 86; sintered iron; furnished as porous metal bearings and mechanical shapes; ts, 20,000 psi; compressive force to cause 0.001-in., permanent set, 16,000 psi; apparent density, 5.8-6.1 grams per cu cm; oil absorption (by volume), 15-20 per cent; coefficient of thermal expansion, (70-200 F), .0000071 in. per deg F.

GRAPH-AL (Alloy steel)—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, Ohio.

C 1.50 avg, Si 0.30 max, Mn 0.30 max, P and S 0.25 max, Al 0.12-0.20; furnished in rough bars or billets, finished rods or bars, straight and coiled strip, wire, sheet, plate and forgings; for machining, hot and cold working, brazing, and arc, gas and resistance welding. For annealing, normalize 1700 F; furnace-cool from 1380-1150 F; quench 1450-1500 F into brine. In annealed state: Ts, 105,000 psi; ys, 53,000 psi; elong in 2 in., 15.5 per cent; impact str, 120+ ft-lb (Izod); quenched hardness, 67-68 rockwell C. Weldability, good; abrasion resistance, high. For applications requiring high impact resistance such as swaging rolls, etc.

GRAPHALLOY (Carbon-graphite metallized materials)—Graphite Metallizing Corp., Yonkers 3, N. Y.

Babbitt; carbon-graphite metallized (impregnated) with babbitt; furnished in rough bars, finished rods and bars, for machining. In untreated state: Ts, approx 5000 psi; comp str, 18,400-23,100 psi; hardness. 45-61 (Shore scleroscope); nonmagnetic; max cont. serv. temp, 300 F. For oilless bushings.

Copper; carbon-graphite metallized (impregnated) with copper; furnished in rough bars, finished rods and bars, for machining. In untreated state: Ts, 5000 psi; comp str, 19,200-24,500 psi; hardness, 48-63 (Shore scleroscope); nonmagnetic; max cont. serv. temp. 700 F. For oilless bushings and motor brushes.

Cadmium; carbon-graphite metallized (impregnated) with cadmium; furnished in rough bars, finished rods and bars, for machining. In untreated state: Ts, 4000-5000 psi; comp str, 18,000-20,000 psi; hardness, 45-61 (Shore scleroscope); max cont. serv. temp, 250 F. For oilless bushings and electric contacts.

GRAPHICELL (Porous graphite)—National Carbon Co., Inc., New York 17.

Available in standard and special shapes including cylinders, blocks, open or blind-end tubes, and rods. Uniform high porosity and small pore size; easily machined and fabricated into practically any shape; resistant to acids and alkalies; not subject to fracture and spalling from thermal shock; high electrical conductivity. For filtration gas dispersion, etc.

GRAPHITAR (Carbon-graphite) — United States Graphite Co., Saginaw, Mich.

Used for bearings, thrust washers, seals, rotor vanes, etc., made in several grades of which the following is typical. Comp str, 22 000 psi; apparent density (gr per cu cm), 1.77; transverse breaking strength, 10 500 psi; scleroscope hardness, 85; coef of thermal expansion 75-620 F (in. per in. per deg F). 0.0000015.

GRAPH—M.N.S. (Alloy steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.

C 1.5, Mn 1.25, P 0.025 max, S 0.025 max, Si 1, Ni 1.75, Mo 0.5, Cr 0.5; in hot-rolled bars and billets, finished rods and bars, wire, sheets, strip, plates and forgings. Has high resistance to abrasion, and nonscuffing properties when cold forming metal; ts, annealed, 135,000 psi; medium ductility. Weldability, good; bhn, annealed, 241; heat-treated 682. Used for various types of machine parts, having light walls and nonuniform sections as well as cold-working dies and tools.

GRAPH-MO (Alloy steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

C 1.5, Si 0.8, Mn 0.4, P and S 0.025 max, Mo 0.25; in hot-rolled bars or billets, finished rods or bars, wire, strips, sheets, plates and forgings. Has high abrasion resistance; ts, 85,000 psi, min; medium ductility; fair bearing properties; good weldability; good nonscuffing properties; bhn, annealed, 197, heat-treated, 745. Used for jigs, fixtures, dies and tools. All parts requiring resistances to wear and nonscuffing properties.

GRAPHO (Babbitt metal)—Lehigh Babbitt Co., Allentown, Pa.

Babbitt metal of different grades, mixed with graphite; can be poured as regular metal without losing graphite content. Mechanical properties similar to those of other babbitt metals. For bearings.

GRAPH-SIL (Alloy steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

C 1.5, Si 0.9-1, Mn 0.5 max., P and S .025 max; in hot-rolled bars or billets, finished rods or bars, seamless tubing, wire, sheets, strips, plates and forgings. Ts, 97,500 psi; abrasion resistance, high; medium ductility; ys, 56,000 psi; elong in 2 in., 25.5 per cent; bhn, 187; excellent machining and nonscuffing properties; good weldability. For use as cylinder liners, pump liners, brake drums, and tools and dies.

GRAPH-TUNG (Alloy steel)—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, Ohio.

C 1.50 avg, Si 0.65 avg, Mn 0.50 max, Mo 0.50 avg, W 2.80 avg; furnished in rough bars or billets, finished rods or bars, straight strip, wire, sheet, plate, and forgings; for machining, hot and cold working, brazing, and arc, gas and resistance welding. Weldability, good; abrasion resistance, high. For parts requiring maximum wear resistance.

GRATON & KNIGHT LEATHERS (Mechanical leathers)—Graton & Knight Co., Worcester 4, Mass.

Leather furnished in sheets for molding. Abrasion resistance, high; resistant to all petroleum products, all fats and oils and most organic solvents. Max cont serv temp, 130-190 F depending on moisture and service condition; inflammable; flexibility, high; ts, 5000 psi avg; elongation, up to 50%; moisture absorption, high; available in natural color; sp gr, 0.95-0.99. For leather belting, hydraulic, pneumatic and vacuum sealing members for either rotating, reciprocating or static machine members. Material can be made to possess an extremely high coefficient of friction.

GUMMON (Cold-molded thermosetting plastics)—Garfield Mfg. Co., Garfield, N. J.

Black, cold-molded, corrosion and heat-resistant (450 F); high dielectric strength; high polish; resistant to hot oil. Will not shrink, crack, warp or deteriorate with age; takes high polish; noninflammable. Used for insulated parts, etc.

GUNITE (Cast irons and cast steels)—Gunite Foundries Corp., Rockford, Ill.

A; processed cast iron, in untreated state; Ts, 40,000 psi; bhn, 223.

A-1; processed cast iron. Oil quench for brinell over 400. In untreated state: Ts, 40,000 psi; bhn, 223.

B-1; processed cast iron. Oil quench for high hardness. In untreated state: Ts, 50,000 psi; bhn, 255.

C; processed cast iron. In untreated state: Ts, 35,000 psi; bhn, 212.

D; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 45,000 psi; bhn, 248.

E; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 45,000 psi; bhn, 229.

E-1; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 40,000 psi: bhn, 223.

F; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 50,000 psi; bhn, 262.

R; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 50,000 psi; bhn, 269.

S; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 45,000 psi; bhn, 248

Also standard ASTM grade malleable irons as follows:

35018; castings. In annealed state: Ts, 53,000 psi; ys, 35,000 psi; elong in 2 in., 18 per cent min; bhn, 130.

32510; malleable castings. In annealed state: Ts, 50,000 psi; ys, 32,500 psi; elong in 2 in., 10 per cent min.

50004; pearlitic malleable iron castings. In heat-treated state: Ts, 80,000 psi; ys, 50,000 psi; elong in 2 in., 4 per cent min; bhn, 207.

Cast steels available as follows:

30-70; in heat-treated state: Ts, 70,000 psi min; ys, 35,000 psi min; elong in 2 in., 24 per cent min; bhn, 150.

45-80; in heat-treated state: Ts, 80,000 psi min; ys, 40,000 psi min; elong in 2 in., 17 per cent min; bhn, 170.

32X105; in heat-treated state: Ts, 105,000 psi min; ys, 85,000 psi min.; elong in 2 in., 15 per cent min; bhn, 217.

H

HANDY FLUX (Welding rod)—Handy & Harman, New York 7.

For brazing steel, stainless steel, Monel metal, nickel, copper, beryllium-copper, brass, bronze, aluminum-bronze and various other ferrous and nonferrous metals and alloys. Liquid and active at 1100 F.

HARDEX (Arc welding electrode)—Metal & Thermit Corp., New York 5.

A series comprising Nos. 20, 25, 45 and 60, for hard facing drills, dippers, hammers, rollers, crushers, wobblers, sprockets, spindles, impellers, idlers, scraper blades, wearing plates, etc.; with characteristics such as high corrosion resistance, high abrasion resistance and good bearing qualities.

HARDWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

High-carbon arc welding electrode having Bhn of 225-488. Provides dense, tough surface of moderate hardness to enable various steel parts to resist shock and abrasion; for locomotive or crane tire flanges, etc.

Type 50; medium-carbon steel electrode for building up steel parts and surfaces. Deposit has considerable resistance to deformation and wear, and is machinable at slow speed. Coating stabilizes the arc and permits deposition of a tough, dense medium carbon steel. Hardness, deposited on straight-carbon steel and allowed to cool naturally, 20 to 35 Rockwell C.

HARDY (Metal powders)—Charles Hardy Inc., New York 17.

Metal powders of various kinds including aluminum, brass, copper, iron, tungsten, manganese, nickel, etc.; available commercially; when compressed into parts give most physical characteristics which are available from metal or alloys produced by melting and casting. According to metal powders chosen and method of processing, variations in all of the propreties can be obtained.

HARRIS 80-10-10 (Copper-tin alloy) — Arthur Harris & Co., Chicago 7.

Cu 80, Sn 10, Pb 10; furnished as sand castings. Used for bearings and pressure castings.

HARRIS SILENTBLOC (Metal-rubber composition)—Harris Products Co., Cleveland, O.

Metal combined with natural or synthetic rubber for mountings and bearings. Used for machine mounts to control vibration, oscillating or torque joints, spring-shackle bushings. Applications include automotive, farm machinery, aircraft, railroad, and electrical equipment, etc.

HARVEL (Insulating varnishes)—Irvington Varnish & Insulator Co., Irvington, N. J.

Special phenol-formaldehyde, polymerization type varnishes with exceptional penetrating power, excellent electrical properties; noncorrosive; unusual resistance to acids, dilute alkalies, moisture, lubricating and transformer oil; save baking time required; harden by polymerization rather than oxidation and cure to infusible nonthermoplastic state. For use with any type of insulation. Also oleoresinous types in clear and black, air-drying, baking.

Oil stop; oilproof, waterproof, heat-resistant, phenol-aldehyde used in splicing electrical cables; to seal and insulate electrical coils. Applied as a viscous liquid, it hardens by polymerization to an infusible, nonthermoplastic state; adheres to rubber, oil-impregnated paper, varnished cambric, fiber, bakelite and copper.

HASCROME (Hard facing rods)—Haynes Stellite Co., Kokomo, Ind.

Cr 10-14, C 0.80-1.20, Mn 3-5, Fe balance; welding rod for hard facing parts subject to abrasion and impact, and castings to resist abrasion and impact.

HASKELITE (Plywood)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Resin-bonded plywood; light weight; high strength; elastic; hardenable into desired forms and shapes. Used for airplanes, buses, railways, radio cabinets and speakers, passenger cars, etc.

HASTELLOY (Nickel-base alloys)—Haynes Stellite Co., Kokomo, Ind.

A; C 0.02-0.12, Mo 17-21, Fe 17-21, Ni balance. Furnished in rough bars, finished rods or bars, straight strip, welded tubing, wire, sheet, plate, and as sand castings; for machining, hot working, stamping, drawing and arc, gas and resistance welding. As cast: Ts, 69-78,000 psi; ys, 42,500-45,000 psi; elong, 8-12 per cent; bhn, 155-200; impact str, 25-35 ft-lb (Izod). Rolled, annealed: Ts, 110-120,000 psi; ys, 47-52,000 psi; elong, 40-48 per cent; bhn, 200-215. For all types of chemical equipment, coils, vessels, heat exchangers, etc.

B; Mo 24-32, Fe 3-7, C 0.02-0.12, Ni balance. Furnished in rough bars, finished rods or bars, straight strip, welded tubing, wire sheet, plate and castings; for machining, hot working, drawing, brazing, and arc, gas and resistance welding. As cast: Ts, 75-82,000 psi; ys, 55-57,000 psi; elong, 6-9 per cent; hardness, rockwell B, 92-99. Rolled-annealed: Ts, 130-140,000 psi; ys, 60-65,000 psi; elong, 40-45 per cent; hardness, rockwell B, 96-100; sp gr, 9.24; abrasion resistance, medium. For all types of chemical equipment and turbine blading.

C; Mo 14-19, Fe 4-8, C 0.04-0.15, Cr 12-16, W 3-5.5, Ni balance. Furnished in rough bars, finished rods or bars, welded tubing, wire, sheet, plate and castings; for machining, hot working, stamping, drawing, brazing and arc, gas and resistance welding. As cast: Ts, 72-80,000 psi; ys, 45-48,000 psi; elong in 2 in., 10-15 per cent; hardness, rockwell B, 89-97. Rolled annealed: Ts, 115-128,000 psi; ys, 55-65,000 psi; elong in 2 in., 25-50; hardness, rockwell C, 50-55. Sp gr, 8.94; max cont. serv. temp, 2000 F; abrasion resistance, medium. For all types of chemical quipment, also exhaust gas systems for aircraft, heat-treat furnace parts, and carburizing furnace parts.

D; Si 11, Cu 2-5, Al 1 max, Ni balance. Furnished as castings and cast welding rod. In untreated state: Ts, 36-40,500 psi; hardness, rockwell C, 50-55; sp gr, 7.80; nonmagnetic; max cont. serv. temp, 1200 F; abrasion resistance, high. For equipment for handling hot sulphuric acid, also for wear parts such as sleeves, bushings, etc.

HAVEG 41, 48, 60 (Furane thermosetting plastics)—Haveg Corp., Newark 23, Del.

Furnished in sheets, rods and tubes, for compression molding and casting. Abrasion resistance, medium; resistant to acids, alkalies and solvents; max cont serv temp, 300 F. Principally used for process equipment such as tanks, valves, pumps, pipe, fans, fume ducts, etc.

HAYNES STELLITE (Co-Cr-W welding rods and castings)—Haynes Stellite Co., Kokomo, Ind.

1; Cr 28-34, W 11-15, Co balance. Cast hardfacing rod. In untreated state: Ts, 47,000 psi; comp str, 256,000 psi; hardness, rockwell C, 54 (gas welded) and 45 (arc wlded); sp gr, 8.59; nonmagnetic; max cont. serv. temp, 2000 F; abrasion resistance, high. For hardfacing farm implements, screw conveyors, mixing machine plows, bed plates, guides, cams, scrapers, stripping knives, and other applications requiring resistance to heat, abrasion and corrosion or combinations of these, and where only moderate shock is encountered.

6; Cr 25-31, W 3-6, Co balance. Hardfacing rod. Ts, 105,000 psi; comp str, 220,000 psi; elong in 2 in., 1 per cent; hardness, rockwell C, 40-46; sp gr, 8.38; nonmagnetic; weldability, good; max cont. serv. temp, 2000 F. For valves, disk gates and plugs for steam, gas H_2O, knives, strippers, rolls, shafts, sleeves, etc., where heat, abrasion and corrosion resistance are required, and where more ductility and shock resistance is needed than that of Alloy No. 1.

12; Cr 26-32, W 6-10, Co balance. Hardfacing rod and castings. In untreated state: Ts, 76,000 psi; comp str, 193,000 psi; hardness, rockwell C, as cast, 46-58, as deposited, gas, 48; sp gr, 8.40; nonmagnetic; max cont. serv. temp, 2000 F. For guides, hammers and other applications similar to those given for Nos. 1 and 6, where higher strength and abrasion resistance is required.

21; C 0.20-0.35, Cr 25-30, Ni 1.50-3.5, Mo 4.5-6.5, Fe 2 max. Furnished in sheets and sand and precision castings, for hot working, brazing and arc, gas and resistance welding. In untreated state: Ts, 101,300 psi; ys, 82,300 psi; elong in 2 in., 8.2 per cent; hardness, rockwell C, 28-32; sp gr, 8.30; nonmagnetic; max cont. serv. temp, 2000 F; abrasion resistance, high; good long-time properties at elevated temperatures. Endurance strength in alternate bending at 120 cycles per second at 10^8 cycles, room temp, 35-40,000 psi: at 1200 F, 44,000 psi; and at 1500 F, 33,000 psi. For turbine blading, exhaust systems for aircraft and other high-temperature applications.

23; C 0.35-0.50, Cr 23-29, Ni 1.50 max, W 4-7, Fe 2 max, Co balance. Furnished in sheets and castings, for hot working, brazing, arc, gas and resistance welding. In untreated state: Ts, 105,400 psi; ys, 58,400 psi; elong in 2 in., 7 per cent; hardness, rockwell C, 28-32; sp gr, 8.54; nonmagnetic; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp, 2000 F; abrasion resistance, medium. For turbine blading and other high-temperature applications. Material has good long-time properties at elevated temperatures.

27; C 0.35-0.50, Cr 23-29, Mo 5-7, Fe 2 max, Co 30 min, Ni balance. Furnished in sheet and castings, for hot working, brazing, and arc, gas and resistanc welding. In untreated state: Ts, 82,500 psi, ys, 46,900 psi, elong in 2 in., 7 per cent; hardness, rockwell C, 17-22; sp gr, 8.21; nonmagnetic; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp, 2000 F; abrasion resistance medium. Good long-time elevated-temperature properties. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles, at 1200 F, 41,000 psi; at 1500 F, 38,000 psi. For turbine blading and other high-temperature applications.

30; C 0.35-0.50, Cr 23-29, Ni 13-17, Mo 5-7, Fe 2 max, Co balance. Furnished in sheets and castings, for hot working, brazing and arc, gas and resistance welding. In untreated state: Ts, 100,000 psi; ys, 65,000 psi; elong in 2 in., 6 per cent; hardness, rockwell C, 28-32; sp gr, 8.31; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp, 2000 F; abrasion resistance, high. Excellent long-time properties at elevated temperatures. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles, at 1200 F, 41,000 psi; at 1500 F, 38,000 psi, For turbine blading and other high-temperature applications.

31; C 0.45-0.60, Cr 23-28, Ni 9-12, W 6-9, Fe 1.50 max. Co balance. Furnished in sheets and castings; for hot working, brazing, and arc, gas and resistance welding. In untreated state: Ts, 101,000 psi: ys, 74,100 psi; elong in 2 in., 11 per cent; sp gr, 8.61; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp, 2000 F; abrasion resistance, high. Excellent long-time properties at elevated temperatures. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles: at 1200 F, 41,000 psi; at 1500 F, 38,000 psi. For turbine blading, etc.

93; Xe 15-19, Co 4-7, V 0.5-3 Mo 13-17, Fe balance. Cast welding rod; heat to 1950 F and air cool. As cast: Ts, 43,000 psi; comp str, 407,800 psi; hardness, rockwell C, 62 as deposited, gas welded. In heat-treated state: Ts, 34,700 psi; comp str, 285,300 psi; hardness, rockwell C, gas welded, heat treated, 66-67; arc welded, heat treated, 63-64. Suitable for hardfacing where high cold hardness is necessary and corrosion is not an important factor; for applications which tend to grind away a metallic surface, such as dredge pump impellers, cement clinker crusher rolls, etc.

92M2; Cr 27-31, W 16-19, Co balance. Furnished as castings. In untreated state: Ts, 63,000 psi; hardness, rockwell C, 62-64; nonmagnetic; resists corrosion caused by high-temperature oxidation; max cont. serv. temp, 1800 F; abrasion resistance, high. For metal-cutting tools, for cast iron, steels, nonferrous alloys and nonmetallic materials; gages, bushings and special castings requiring resistance to heat, abrasion and corrosion, or combinations of these.

Star-J Metal; Cr 29-34, W 15-19, Co balance. Furnished as castings. In untreated form: Ts, 65,000 psi; hardness, as cast, rockwell C, 58-62; sp gr, 8.76; nonmagnetic; weldability, good; resists corrosion all atmospheric conditions including brine, also 10 per cent boiling HNO_3, boiling acetic and ferric sulphate, and 10 per cent solutions of ferric chlorides; max cont. serv. temp, 2000 F; abrasion resistance, high. For metal cutting tools, gages, valves and seats, bushings, guide rolls, cam followers, and other special castings requiring resistance to heat, abrasion and corrosion, or combinations of these encountering only moderate shock or impact where maximum hardness is required.

HAYSTELLITE (Tungsten carbide welding rod)—Haynes Stellite Co., Kokomo, Ind.

Hard grade; W 90-96, C 3.50-4.50 and Co 0.50-2.00. In untreated state: Hardness, rockwell A, 82-88, as deposited: abrasion resistance, high. For oil well drilling tools, rock bits, farm implements, earth moving equipment and other applications where utmost resistance to abrasion is necessary.

Tough grade; W 79-85, C 3.50-4.50 and Co 8-11. In untreated state: Hardness, rockwell A, 82-88; abrasion resistance, high. For hard setting oil well drilling tools, earth moving equipment. pulverizing hammers, and other applications where abrasion resistance is required.

HECLA (Forging bronze)—Titan Metal Mfg. Co., Bellefonte, Pa.

A naval bronze; Cu 59, Pb 1, Sn 0.75, balance Zn. Unused where high tensile strength and resistance to corrosion are required.

HEMIT (Cold-molded refractory · material)—Garfield Mfg. Co., Garfield. N. J.

Heat resistance, 1500-1750 F; low moisture absorption when impregnated; high dielectric strength; noninflammable. Used for interior parts of heating devices, or where a molded part must withstand an arc.

HEPPENSTALL (Chrome - nickel - molybdenum steel)—Heppenstall Co., Pittsburgh.

2 C 30; Ni-Cr-Mo steel; C 0.3. For shafting where high torsional strength is required.

5 H 50; C 0.5; Cr-Mo and V alloy; furnished as die blocks. Material is heat-resistant, abrasion-resistant; has high tensile strength and high ductility. Used for strip mill rolls, etc.

HERCULITE (Heat-treated plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat resistant to 650 F; flexibility, medium; ts, 29.500 psi; moisture absorption, low; nonflammable; sp gr, 2.52; transparent; highly polished. For use as windows or any glass application requiring unusual strength.

HERCULOY (Silicon bronze)—Revere Copper & Brass Inc., New York 17.

421; Si 1.75, 0.25 Mn, balance Cu; in rods or bars, tubing, wire, sheets, strips (coiled) and plates; for hot forging, stamping, extruding, welding, deep drawing and cold forging Corrosion-resistant; medium abrasion-resistant; ts, 45-90,000 psi; high ductility. For cold-headed bolts, nuts, screws, nails, etc.

420; Si 3, 1 Mn, balance Cu; furnished in rods or bars, tubing, wire, sheets, strips (coiled) and plates: for hot forming, stamping, extruding, welding, deep drawing and cold forging. Ts, 55-110,000 psi; high ductility. Used for range boilers, and for applications requiring high strength in combination with good weldability and corrosion resistance.

HERESITE (Thermosetting phenol-formaldehyde powder)—Heresite & Chemical Co., Manitowoc, Wis.

Synthetic phenol-formaldehyde molding · powders having high chemical resistance, with exception of strong alkalies. Max cont serv temp, 300 F; inflammable; flexibility, low; dielectric str, 300 volts per mil; ts, 6000 psi; comp str. 15,000 psi; trans str, 9000 psi; flex str, 9000 psi; elong in 2 in., 0.6%; moisture absorption, low; available in black, brown, red, green and tan; sp gr, 1.3-1.5; Bhn, 30; coef of thermal expansion, 4 x 10^{-5} in./in./degree C. For dials, knobs, gages, insulators, housings, closures, handles, etc.

HIDEN (Laminated plastics)—Parkwood Corp., Wakefield, Mass.

Furnished in plates for machining. Abrasion resistance, medium; resists weak acids and alkalies; max cont. serv. temp, 200-250 F; slow burning; rigid; dielectric str, 200-500 volts per mil; ts, 35,000 psi; comp str, 20,000 psi; flexural str, 30,000 psi; moisture absorption, low; available in amber color; opaque; sp gr, 1.30-1.35; machinability, good. For use where lightweight and strength are required, such as textile picker sticks, etc.

HIGH DENSITY ALLOY 112 (High tungsten alloy)—Callite Tungsten Corp., Union City, N. J.

Contains 85-90% tungsten. Furnished in rough bars or billets, finished rods or bars. Ts, 60-80,000 psi; ys, 70-75,000 psi; elong in 2 in., 1-2%; hardness, Rockwell A, 60-64. Can be silver soldered and brazed using regular technique. Is readily machinable; can be shaped, drilled, tapped in much the same fashion as a good grade of cast iron. At elevated temperatures red heat or thereabouts, it oxidizes slowly. At ordinary room temperature it resists atmospheric corrosion almost completely. Is particularly suited for balancing weights where space is at premium; for example, balancing weight for crankshafts for aircraft engines; balancing weight for controlling pitch in air screws, for centrifugal clutch plates, for rotors in gyroscopic devices. Because of its high density, it may also be used as a container for radio-active substances and as an absorption screen for radio-active radiations and x-rays.

HILLS McCANNA (Magnesium and aluminum-base alloys)—Hills-McCanna Co., Chicago.

Magnesium and aluminum base alloy sand castings.

HIPERCO (Iron-cobalt alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

Contains approximately 1/3 cobalt, 2/3 iron and 1 to 2 per cent of another element to increase electrical resistivity. Has high magnetic saturation value, also high permeability for magnetizing. Furnished in straight strip, sheet and plate for machining, and hot and cold forging. In untreated state: Ts, 25,000 psi; ys, 20,000 psi; elong in 2 in., 1-2 per cent; sp gr, 8.00. For electrical parts where high magnetic saturation value and high permeability for magnetic forces is desired.

HIPERNIK (Magnetic alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

A magnetic alloy consisting of 49.5 per cent nickel and 49.5 iron, manganese 0.1; extremely ductile. Developed for special magnetic properties at moderately low induction, primarily for radio applications. Also used for transformer laminations, melting point is 1450 C. For relays, radio and current transformers, etc.

HIPERSIL (Magnetic silicon iron)—Westinghouse Electric Corp., East Pittsburgh, Pa.

A high-permeability silicon iron whose magnetic qualities exist only in the rolling direction. Lightweight; in finished core form only. For a variety of applications in communications field, including radio transformers, chokes, relays, reactors, etc. Available in three grades.

HI-STEEL (Corrosion resistant alloy) — Inland Steel Co., Chicago 3.

A low-alloy, high-strength steel furnished in plate, sheet, strip, structurals and bars; ts, 70,000 psi; ys, 50,000 psi; elong in 2 in., 22%; endurance limit, 49,000 psi. Suitable for hot or cold working, stamping, drawing, brazing, and welding. Can be precipitation hardened for higher mechanical properties. For reducing deadweight and increasing payload of equipment such as railroad freight and passenger cars, trucks, busses, mine cars, street cars, earth moving machinery, concrete mixers, etc. Has a high abrasion resistance and a high resistance to atmospheric corrosion.

HITENSILOY (Forging bronze) — Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 57, Pb 1, Ni 1.5, balance Zn. Ts, 80-95,000 psi; ys, 40-50,000 psi; elong in 2 in., 20-30 per cent; hardness, 70-90 rockwell B; modulus of elasticity, 25,000,000 psi. Has high strength and good corrosion resistance combined with good machinability. Used for pump rods, valve stems, bolts, nuts, etc.

HITEST (Cast iron)—The Medart Co., St. Louis.

For ordinary cast-iron uses and for cast steel in some applications. Material is corrosion-resistant; has high tensile strength and good machinability.

HOMALITE (Thermosetting plastics) — The Homalite Corp., Wilmington 166, Del.

Type 100; furnished in sheets, rods or tubes, for casting, stamping and machining. Abrasion resistance, high; resistant to dilute acids, alkalies and all organic solvents; max cont serv temp, 300 F; dielectric str, 500 volts per mil; flexibility, low; ts, 5000 psi; flex str, 5,000 psi; moisture absorption, low; available in all colors; sp gr, 1.21; transparent, translucent, opaque.

Type 200; furnished in sheets for casting. Abrasion resistance, high; chemical resistance, excellent; max cont serv temp, 250 F; dielectric str, 500 volts per mil; ts, 2000 psi; flex str, 3000 psi; available in all colors; shatterproof; sp gr, 1.0; transparent, translucent, opaque.

HOTFORM (Hot-work die steel)—Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

Hot-work die steel of 5% Cr type, available in three types; all furnished in rough bars or billets, finished rods or bars, sheet, plate, forgings and drill rod; for precision casting, machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Hardness, rockwell C, 55-59 max; magnetic; weldability, fair; max cont. serv. temp, 800-1000 F; good bearing qualities.

HOYT (Babbitt metal)—National Lead Co., New York 6.

Analysis of material varies according to the bearing application.

HUNT-SPILLER Gun Iron (Cast iron)—Hunt-Spiller Mfg. Corp., Boston 27.

Air furnace cast iron with analysis in accordance to customer's specification; furnished as sand castings. In untreated state: Ts. 35.000-60 000 psi. Outstanding characteristics: Uniformity, soundness, pressure tight, heat, abrasion and wear resistance. For pressure cams, gears and rings.

HUSSEY (Copper)—C. G. Hussey & Co., Div. of Copper Range Co., Pittsburgh.

Copper sheet, strip, drawn tubing and shapes, wire and rod to specification. Good machinability, weldability and formability. High general corrosion resistance. Excellent · for electrical switch parts, bellows, eyelets, deep-drawn parts, trim for appliances, etc. Provides exceptionally good base for plating.

HYCAR (Synthetic rubber) — B. F. Goodrich Chemical Co., Cleveland 15.

Vulcanizable types of American (synthetic) rubbers of butadiene base furnished in crude sheet form to be compounded into any type of stock desired for further processing by molding, extruding, calendering, etc.

Type OR-15 (oil-resistant); vulcanizable American (synthetic) rubber, butadiene-acrylonitrile copolymer; furnished in sheet form; for molding, extruding and calendering; excellent oil, heat, abrasion and aging resistance; good flex life: ts. 2500-4500 psi; dielectric strength, 500 volts per mil; moisture absorption, medium; may be compounded in colors, or for blending with vinyl and phenolic resins. Used for all resilient parts.

Type OR-25 (oil-resistant); vulcanizable American (synthetic) rubber, butadiene-acrylonitrile copolymer: furnished in sheet form; for molding, extruding and calendering; abrasion resistance, high; resists corrosion caused by petroleum products: heat-resistant to 300 F; flexibility, high: dielectric strength, 500 volts per mil; ts, 2000-3500 psi; moisture absorption, low. May be compounded in colors.

Type OS-10 (oil-soluble); vulcanizable American (synthetic) rubber, butadiene-styrene copolymer; furnished in sheets; for molding, extruding and calendering; flexibility, high;

ts, 2000-3000 psi; moisture absorption, low; takes color. For abrasive wheels, electrical insulation, and general replacement for natural rubber.

All types used for gaskets, tubing, vibration insulators, packings, hose, printing rollers and blankets, wire covering and jacketing, and any other general type of application where resilient materials are required. All can be compounded to bonehard (Ebonars) with a 100 F higher softening point than obtainable with natural hard rubber. All types also available in latex state for spreading, dipping and coating.

HYDROCAL (Gypsum cements)—United States Gypsum Co., Chicago 6.

Pattern Shop Hydrocal; has moderately low setting expansion; dimensional accuracy; is plastic, free forming and particularly suited for pattern and model making. A general-purpose gypsum cement which can be carved or otherwise worked freely.

A 11; a high strength gypsum cement with an exceptionally low setting expansion. Has a short period of plasticity and stiffens rapidly. This makes it difficult to form under a template.

B 11; has a low setting expansion, high degree of plasticity, gradual setting action, and is specifically designed for use in the production of built-up models or template-formed models. It is harder to carve than Pattern Shop Hydrocal.

HYDROSTONE (Gypsum cement)—United States Gypsum Co., Chicago 6.

Extremely hard and strong; cannot be worked under a template; used where extreme surface hardness is required; expansion is greater than Grade A-11 or B-11 HYDROCAL.

HYFLEX (Rubber-like plastics tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Has excellent abrasion resistance; does not become brittle at temperatures as low as —58 F; obtainable in six opaque colors; dielectric str, 1000 volts per mil (dry), 800 volts per mil (wet), for tubing of wall thicknesses approximately 0.020 in.; ts, 3000 psi; good chemical stability. For moderately low-temperature applications, wire insulation, conduit, lug insulation, low-pressure hose.

HYLASTIC (Cast steels) — American Steel Foundries, Industrial Div., Chicago 11.

Wide variety of carbon, low alloy, corrosion and heat resistant steels furnished in sand castings to specification.

HY-SPEED (Bearing bronze)—Buckeye Brass & Mfg. Co., Cleveland.

Cu 88, Sn 10, Pb 2. Bronze bars to customers' specifications in any ID, OD and length, slotted, drilled, flanged or threaded.

HYTEMCO (High alloy nickel iron)—Driver-Harris Co., Harrison, N. J.

Alloy of nickel and iron characterized chiefly by its high-temperature coefficient of electrical resistance. Lends itself advantageously to uses requiring self regulation by temperature such as immersion heaters.

HY-TEMP (Composition) — Keasbey & Mattison Co., Ambler, Pa.

Diatomaceous earth and asbestos base; combination heat-insulating blocks, cements and pipe covering; furnished in powder or molded form; high heat resistance; low moisture absorption; noninflammable; and low thermal conductivity. Used for thermal insulation up to 1900 F.

HY-TEN (Alloy steel)—Wheelock, Lovejoy & Co. Inc., Cambridge 39, Mass.

A-1X; C 0.20, high Mn-Mo alloy steel, furnished in rough bars or billets, finished rods or bars and forgings; for machining and hot working, heat treated state; ts, 110,000 psi; ys, 65,000 psi; elong in 2 in., 25 per cent; impact str, 85 ft lb (Izod); weldability, fair; abrasion resistance, high. For gears, bushings, cams, clutches, bolts, etc.

B-2; C 0.40, Mn-Cr alloy steel; furnished in rough bars or billets, finished rods or bars and forgings; for machining and hot working. Untreated state, ts, 100,000 psi; ys, 60,000 psi; elong in 2 in., 26 per cent; bhn, 187; weldability, fair. For shafts, gears, spindles, screws, studs, racks, etc.

B-3X; C 0.50, Mn-Cr-Mo alloy steel; furnished in rough bars or billets, finished rods or bars, and forgings; for machining and hot forging. In heat-treated state: Ts, 181,000 psi; ys, 164,000 psi; elong in 2 in., 14 per cent; impact str, 30 ft-lb (Izod); bhn, 388; weldability, fair; max. cont. serv. temp, 900 F. For gears, axles, spindles, clutches, etc.

B Temper No. 5; C 0.95, electric furnace steel; furnished in rough bars or billets, finished rods or bars and forgings; for machining and hot working. In heat-treated state: Hardness, rockwell C, 65; abrasion resistance, high; machinability, good. For cold heading dies, rolls, bushings, gages, cams, etc.

M Temper; C 0.70, Cr-Ni-Mo alloy steel; furnished in rough bars or billets, finished rods or bars and forgings; for machining and hot working. In heat-treated state: Ts, 294,000 psi; ys, 270,000 psi; elong in 2 in., 5½ per cent; impact str, 5 ft-lb (Izod); hardness, rockwell C 60. For rolls, cams, clutches, collets, gears, gages, etc.

HY-TEN-SL (Aluminum manganese bronzes)—American Manganese Bronze Co., Philadelphia 36, Pa.

Available in five grades as rough bars or billets, finished rods or bars, castings and forgings, as follows:

No. 1; Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. In untreated state: Ts, 10,800 psi min; comp ys, 58,000 psi min; ys, 65,000 psi; elong in 2 in., 14 per cent; impact resistance, medium; bhn, 220; practically nonmagnetic; weldability, fair; heat resistant to 500 F; abrasion resistance, medium; pressure resistance, good. Used for lifting nuts, housing nuts, worm wheels (slow speed), spur and bevel gears, etc.

No. 1A; Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. In untreated state: Ts, 11,500 psi min; comp ys, 65,000 psi min; ys, 75,000 min; elong in 2 in., 12 per cent; impact resistance, medium; bhn, 240 min; practically nonmagnetic; weldability, fair; resists corrosion caused by water, air, etc.; heat resistant to 500 F; abrasion resistance, medium. For same applications as No. 1.

No. 2 (sand cast); Ts, 100,000 psi; ys, 55,000 psi; elong in 2 in., 15 per cent; comp ys, 50,000 psi.

No. 3; Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. In untreated state: Ts, 90,000 psi min; comp ys, 40,000 psi min; ys, 45,000 psi min; elong in 2 in., 20 per cent min; impact resistance, medium; bhn, 175; practically nonmagnetic; weldability, fair; resists corrosion caused by air, water, etc; heat resistant to 500 F; abrasion resistance, medium; good pressure resistance. For applications same as Nos. 1 and 1A.

No. 4 (sand cast); Ts, 85,000 psi; ys, 40,000 psi; elong in 2 in., 25 per cent; comp ys, 35,000 psi.

Also producers of manganese-bronze sand and centrifugal castings, hot-rolled and extruded rods, bars, shapes and sheets and forgings; gun metal sand and centrifugal castings; phosphor bronze sand castings; red brass sand and centrifugal castings; valve bronze sand castings; nickel-bronze and cupro-nickel castings; silicon bronze sand, centrifugal and permanent-mold castings, forgings, rods, bars, sheets, tubing and extruded sections; and bearing bronzes.

I

IDEAL ELECTRIC STEEL (Carbon and alloy steels)—The National Supply Co., Torrance, Calif.

Sand castings and open die forgings of various carbon and alloy steels produced to standard specifications such as SAE, AISI, and ASTM, etc.

IDEALOY (Bearing alloy)—Wellman Bronze & Aluminum Co., Cleveland.

Copper-tin-zinc alloy for heavy-duty bearings.

ILLINOIS (Sheet and strip zinc)—Illinois Zinc Co., Chicago 32.

Furnished in straight and coiled strip and in sheet and plate, for stamping and drawing. In untreated state; ts, 25,000 psi; weldability, poor; ductility, high. For nameplate and instruction plates, transformer cases, etc.

ILLIUM G (Cast nickel alloy)—Burgess-Parr Co., Freeport, Ill.

Ni 54-58, Cr 20-24, Cu 5-7, Mo 5-7, Mn 0.75-1.5, Si 0.65 max, C 0.2 max. Available in sand castings, permanent-mold castings, and precision castings to specifications. Other methods of fabrication include machining and arc, gas and resistance welding. No heat treatment required. Ts, 60-73,000 psi; elong in 2 in, 4 to 9.5%; Charpy impact, 40.3-52.1 ft-lb at room temperature; Bhn, 160-210; sp gr, 8.31; nonmagnetic; weldability, good; max cont serv temp, 1900 F; abrasion resistance, medium to good. Resists most corrosive solutions in a wide range of temperatures and concentrations including the halogens in dry state and their salts and acids in low concentrations at ordinary temperatures. For pumps, meters, chemical equipment and other parts subject to corrosion.

INCELOID (Thermoplastic plastics) — American Products Mfg. Co., New Orleans.

Cellulose derivative, furnished in sheets for extruding. Abrasion resistance, medium; resistant to mild acids and alkalies, water, hydrocarbons; max cont. serv. temp, 180 F; dielectric str, about 800 volts per mil; ts, 9000 psi; comp str, 11,000 psi; produced in color; moisture absorption, medium; sp gr, 1.27; translucent and transparent; machinability, good. For use as heat and electrical insulating covering.

INCONEL (High Ni-Cr-Fe alloy)—International Nickel Co. Inc., New York.

Furnished in wrought and cast forms. Wrought form: Rod and bar, cold-drawn wire, hot-rolled plate, cold-rolled sheet and strip, cold-drawn tubing. Properties of wrought forms (ranges for various forms and tempers): Ts, 80-185,000 psi; ys, 25-175,000 psi; elong in 2 in., 50-2 per cent; bhn, 120-290. Good corrosion resistance; good hot and cold workability. Good high-temperature properties. For airplane-engine exhaust manifolds, springs that must operate at high temperatures, and in the food and chemical industries it is used for heaters, stills, condensers, tanks, piping, valves, etc. In photographic field it is used for pumps, reels, shafts, etc.

Inconel Castings: Untreated. Ts, 70-95,000 psi; ys 30-45,000 psi; elong in 2 in., 30-10 per cent; bhn, 160-190; nonmagnetic; weldability, good; abrasion resistance, medium; good high-temperature properties; good corrosion resistance. For parts which need high corrosion resistance and/or resistance to elevated temperatures.

INDIUM (Lead-silver solder)—Indium Corp. of America, New York.

A very soft metal used electrolytically or as a constituent of nonferrous alloys; commercial grade 99.9+ per cent pure; furnished in finished rods, bars, foil or powder; sp gr, 7.31; resists corrosion caused by salt spray and acids in oil; abrasion resistance, high. Used for bearing surfaces, protective coating for moving parts subject to wear and corrosion, etc.

INDUR (Phenolic-base plastics)—Reilly Tar & Chemical Corp., Indianapolis.

Thermosetting; furnished in powder form, for molding into parts; ts, 8560 psi; high dielectric strength; nonflammable; low moisture absorption; high heat resistance; corrosion and abrasion-resistant; available in colors; flexibility, medium; sp gr, 1.37±. Used for instruments and machine accessories including insulating panels, knobs and handles, control levers, gears, etc.

INDUR (Varnish)—Reilly Tar & Chemical Corp., Indianapolis.

Phenolic base, thermosetting; for molding into parts; high dielectric and tensile strengths; noninflammable; transparent; corrosion and heat-resistant; impact-resistane; and low moisture absorption. Used for laminated gears.

INDUSTRIAL (Stainless steels)—Industrial Steels, Inc., Cambridge 41, Mass.

For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

INGACLAD (Stainless-clad steel)—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Consists of a layer of 18-8 chrome-nickel, Type 304, also 18-8 columbium stabilized and 18-8 molybdenum bearing, stainless layer bonded to a layer of ordinary steel. Uses include equipment for chemical, food, dairy, processing, brewery, packing house, bottling industries, etc.; suitable for applications requiring stainless steel protection on one surface.

INGERSOLL (Stainless steels)—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Sheet and plate; for data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

INLAND (Steels)—Inland Steel Co., Chicago 3.

All AISI and SAE carbon steels; also carbon steels to ASTM and ARA mechanical property specifications, and chrome-manganese and silico-manganese alloy spring steels. Also can furnish any carbon steel to special chemical or mechanical requirements conforming to the limits set up as acceptable by the AISI.

INSULKOTE (Weatherproof coating) — Johns-Manville, New York 16.

Weatherproof, heat-resistant coating for use over insulation of ducts and other exposed equipment.

INSUROK (Plastics)—The Richardson Co., Melrose Park, Ill.

Thermosetting type; furnished in laminated sheets, rods and tubes for machining into parts, or as finished molded parts; corrosion-resistant; low moisture absorption; high tensile strength; resistant to shock; comparatively low specific gravity. Used for gears, bearings, electrical insulation. Available in different grades.

Thermoplastic type; furnished in molded parts; high dielectric strength; low moisture absorption; high tensile strength; low specific gravity. Available in color.

Translucent type; urea, melamine or phenolic base, thermosetting; in laminated sheets and fabricated parts, for instrument dials, etc. Material is translucent.

INTERLAKE (Plastics resins and molding compounds)—Interlake Chemical Corp., Cleveland 14.

Phenol formaldehyde thermosetting liquid resins for bonding, impregnating, laminating and surfacing. Applications include bonding of mineral wool and fiberglas for insulation, glues for plywood, impregnating wood, paper and cloth for plastics laminates.

Phenol formaldehyde thermosetting molding compounds supplied in powder form with various fillers such as wood flour, fabric or mineral, to be molded under heat and pressure.

INTERNATIONAL (Graphite) — International Graphite & Electrode Corp., St. Marys, Pa.

Graphite electrodes for electric furnaces, graphite anodes for electrolytic cells, graphite molds for casting alloys, pressure sintering and centrifugal casting.

INTERNATIONAL (Nickel)—International Nickel Co. Inc., New York.

Nickel; Ni 99.4, Cu 0.1, Fe 0.15, Mn 2, Si 0.05, C 1, S 0.005; rustproof, corrosion-resistant chemical parts.

L Nickel; a low carbon type of nickel, otherwise similar in chemical composition to nickel. Especially suitable in contact with fused caustic and certain fused salts.

D Nickel; Ni 95.2, Cu 0.05, Fe 0.15, Mn 4.5, Si 0.05, C 0.1, S 0.005. A metal similar to nickel but affording superior mechanical properties and resistance to atmospheric attack at elevated temperatures; corrosion and heat-resistant; for electrical uses.

Z Nickel; Ni 98; heat-treatable material resembling nickel except for its higher mechanical properties which are comparable to those of oil-tempered spring steel; corrosion resistant. Used for products requiring spring properties with corrosion resistance.

Nickel Castings; Untreated; ts, 45-60,000 psi; ys, 20-30,000 psi; elong in 2 in., 30-15 per cent; bhn 85-125; magnetic; weldability, good; abrasion resistance, medium; good corrosion resistance. For chemical and food-processing equipment parts.

INTRA (Tool steel) — H. Boker & Co., Inc., N. Y. C.

Water-hardening tungsten alloy steel. For taps, woodworking tools, mandrels, etc.

INTUC (Plastics laminate)—Insulating Tube Co. Inc., Poughkeepsie, N. Y.

Thermosetting phenol formaldehyde laminate furnished in sheet and tube form; ts, 8265 psi; dielectric strength (volts per mil. inst.), 720, short time; available in natural tan and black; moisture absorption, low; machinability, good.

INVAR (Low expansion alloys)—Carpenter Steel Co., Reading, Pa.

Low expansion iron-nickel alloys, furnished in finished rods, bars, and strip. Various types available to meet expansion rates between different temperature ranges. Free-machining grade for automatic screw machine parts. Analyses for two types are:

Type 36; C 0.12 max, Mn 0.35, Si 0.20 max, and Ni + Co 36.

Type 36 Free-cut; C 0.12 max, Mn 0.35, Si 0.20 max, Ni + Co 36, and Se 0.20.

IRALITE (Alloy cast iron)—Mackintosh-Hemphill Co., Pittsburgh.

C 2.8-3.5, plain and alloyed cast iron; Ni, Mo and Cr as required. Furnished as castings. Ts, 40-75,000 psi; Bhn. 175-400; magnetic; resists corrosion caused by acids; heat-resistant to 1500 F; abrasion resistance, high. For lathe and engine beds, etc.

IRVINGTON (Insulating varnishes) — Irvington Varnish & Insulator Co., Irvington, N. J.

Synthetic, internal-drying, clear and black insulating, oleo-resinous type varnishes; air-drying varnishes; clear or black oilproof finishing varnishes; sticking varnishes, red enamels; gray or black machinery enamels. Wide selection to meet ordinary and special requirements.

IRVINGTON (Varnished fabrics)—Irvington Varnish & Insulator Co., Irvington, N. J.

Varnished cambric, canvas, cotton, duck, Fiberglas, silk, Nylon, rayon and SIC, thin cotton (alternates for silk). Silicone varnished Fiberglas, varnished papers; ranging from thin condenser tissues to heavy fibrous types.

Plastic marker insulators; extruded plastic tubing sleeves, marked to specifications; serve both as wire markers and lug insulators; high dielectric strength; resistant to heat, acids, alkalies, oil and many solvents; do not support combustion. Obtainable in numerous color combinations, and in standard tubing sizes.

Transformer lead tubing; made to specifications, consisting of several layers of varnished cambric over which saturated braid has been drawn; assembly is dipped in varnish and thoroughly baked.

Varnished markers; short lengths of varnished tubing marked to specifications. Used to identify leads; inside-and-out coatings resist oil, gasoline, washing down of motors, high engine temperature.

IRV-O-LITE XTE 30 (Thermoplastic plastics)—Irvington Varnish & Insulator Co., Irvington, N. J.

Thermoplastic, furnished in rods, tubes and for extruding. Abrasion resistance, high; chemical resistance, good; max cont. serv. temp, 170 F; flexibility, high; dielectric str, 1000 volts per mil; moisture absorption, low; produced in black, green, white, yellow, red and blue; sp gr, 1.293; opaque. For wire insulation, conduit, lug insulation, etc.

IRV-O-SLOT (Insulation)—Irvington Varnish & Insulator Co., Irvington, N. J.

Stator or armature slot insulation. Consist of varnished fabrics duplexed to fish or 100 per cent rag papers; flexible binding adhesive prevents separation during shaping and forming, contributes to insulating qualities. Obtainable in a wide variety of combinations and thicknesses in the form of sheets, tape and punchings.

IRV-O-VOLT (Flexible varnish tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Flexible varnished inside-and-outside tubing; obtainable in six colors. Braided cotton, rayon, Fiberglas tubular sleeving, treated with oleo-resinous varnishes.

Types A-1, B-1, C-1 and C-2; conform to ASTM and VTA specifications for similarly designated grades; inside varnish coating yields a smoother inside wall, speeding assemblies; greatly retards moisture absorption; eliminates feathering action of ordinary braid and wicking action when used in oil-filled transformers; provides margin of insulation protection should outside coating become chafed.

Type CT; special heavy-walled saturated sleeving.

IVI-FLEX (Flexible plastics tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Extruded plastics tubing, developed for use at extremely low temperatures; ts, 1000 psi; elongation at break, 400%.

IVORICAST (Phenol formaldehyde thermosetting plastics) — West Coast Plastic Enterprises, Los Angeles 32.

Phenol formaldehyde, thermosetting; furnished as a casting resin; chemical resistance, excellent; max cont serv temp, 300 F; ts, 10,000 psi; comp str, 20,000 psi; impact str, 4 ft-lb (Izod); moisture absorption, low; sp gr, 1.24; translucent and opaque in any color. For small gears, caps, washers, gaskets, insulators, etc.

J

JALLOY (Special steel)—Jones & Laughlin Steel Corp., Pittsburgh 30.

Special steel for use where heavy impact and dynamic stresses are required. For parts such as pins and links on earth-moving, agricultural, mining and oil-well equipment.

JALCASE (Steels)—Jones & Laughlin Steel Corp., Pittsburgh.

Low-carbon open-hearth steel which offers machinability practically equivalent to bessemer screw stock plus the added advantage of rapid case-carburizing properties; manufactured as AISI C-1117 and C-1118 (SAE 1117 and 1118), carbon 0.14-0.20.

Open-hearth steel which in the higher carbon range offers exceptional heat treating qualities combined with forging properties and good machinability; manufactured as AISI C-1132 (SAE 1132), carbon 0.27-0.34; AISI C-1137 (SAE 1137), carbon 0.32-0.39; AISI C-1141 (SAE 1141), carbon 0.37-0.45.

JAMESTOWN (Plywood)—Jamestown Veneer & Plywood Corp., Jamestown, N. Y.

Hot-pressed, resin-bonded plywood; thermosetting; furnished in sheets for machining. Abrasion resistance, low; resists corrosion caused by moisture; heat resistant to 400 F; flexibility, low and medium; approx ts, 2000 psi; comp str, 250 psi; produced in natural wood; largely shatterproof; sp gr, .45-.60; machinability, good.

JEFALOY (Cast iron)—Jeffrey Mfg. Co., Columbus, O.

55M; total C 2.85-3.05, Mn 0.50-0.70, Si varying, Mo 0.70-0.80; furnished as castings; ts, 50-60.000 psi; comp str, 171-174.000 psi; bhn, 248-269. For wear-resistant, high-strength parts.

A Series; C 2.85-3.50, Mn 0.30-0.75, Si varying; furnished as castings; ts 35-50,000 psi; comp str, 126-170.000 psi; bhn 192-248. For pump parts, gears, sprockets, frames, housings, etc.

JESSOP (Stainless steels) — Jessop Steel Co., Washington, Pa.

For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

JEWELL Alloys (Ductile white irons) — Kencroft Malleable Co. Inc., Buffalo 7.

Silicon, approx 1.00, total carbon 1.90, chrome 0.35, and nickel 0.1; furnished as sand castings. Thoroughly heat-treated before shipment and requires no further heat treatment for physicals shown. Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 8%; weldability, fair; resists corrosion caused by heat, mild acids and alkalies; max cont serv temp, 1200 to 1300 F; abrasion resistance, high; polishes like nickel plate by ordinary buffing. For industrial uses.

No. 42; silicon, approx 1.00, total carbon 1.90, chrome 0.20, and nickel 0.50; furnished as sand castings. Thoroughly heat treated before shipment and requires no further heat treatment for physicals shown. Ts, 70,000 psi; ys, 50,000 psi; elong in 2 in., 5%; weldability, fair; resists corrosion caused by heat, mild acids and alkalies; max cont serv temp, 1100 F. Recommended as a free-machining material with high yield point and enough ductility to stand shock and abuse. For all industrial uses.

"V"; silicon, approx 1.00, total carbon 1.90, chrome 0.35, and nickel 0.50; furnished as sand castings. Thoroughly heat treated before shipment and requires no further treatment for physicals shown. Ts, 85,000 psi; ys, 70,000 psi; elong in 2 in., 5%; weldability, fair; resists corrosion caused by heat, mild acids and alkalies; max cont serv temp, 1000 to 1100 F; abrasion resistance, high; especially recommended for compressor valves and wherever battering of two metals is encountered. For all industrial uses.

J & L Steels (Cold-finished steel) — Jones & Laughlin Steel Corp., Pittsburgh 30.

Cold finished steel in bars, shapes, rounds, flats, hexagons and special shapes; easily machined. For gears, tubing, piston pins generator parts and shafts. steering wheel hubs, etc. Also special cold-drawn shapes and Electricweld mechanical tubing.

JODA (Thermoplastic plastics) — Joseph Davis Plastics Co., Arlington, N. J.

Furnished in sheet. strip, rods or tubes, plates and film. Abrasion resistance, medium; max cont serv temp, 130 F; furnished transparent and in all colors; is shatterproof; sp gr, from 0.9-1.3; machinability, good. Used for dials, lenses, knobs, wheels, etc.

JODAPAC (Thermoplastic plastics)—Joseph Davis Plastics Co., Arlington, N. J.

Polythene or polyethylene thermoplastic plastics furnished in sheet. rods, tubes, and film. Max cont serv temp, 100F; dielectric strength (volts per mil. inst.), 400-600; ts, 17-1900 psi; produced in all colors; moisture absorption, low; sp gr, 0.92; produced transparent, translucent, and opaque; machinability, fair. Used in electroplating industry, food packaging, etc.

JOHNSON (Bearing metals) — Johnson Bronze Co., New Castle, Pa.

Babbitts furnished in following grades:

No. 10 (SAE 10); Sn 90, Cu 5, Sb 5; furnished in rough bars or billets, for permanent-mold casting and die casting. Ts, 10-13,000 psi; comp str, 5-7000 psi; bhn, 28-30; sp gr, 7.2; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont. serv. temp, 200-250 F; abrasion resistance, high. For automotive main and connecting-rod bearings; high-speed, medium-load and precision-assembly bearings, etc.

No. 11 (SAE 11); Sn 87, Sb 7, Cu 6; furnished in rough bars or billets for permanent-mold and die casting. Ts, 10-13,000 psi; comp str, 5-6000 psi; bhn, 28-29; sp gr, 7.2; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont. serv. temp, 200-250 F. For automotive main and connecting-rod bearings subjected to heavy pressures.

No. LX (SAE 14); Pb 74-75, Sb 15, Sn 10, Cu 0.25; furnished in rough bars or billets, for permanent-mold or die casting. Annealed before machining. In untreated state: Ts, 8-12,000 psi; comp str, 5-6000 psi; bhn, 27-29; sp gr, 10.0; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont. serv. temp, 175-250 F; abrasion resistance, high. For car box journals, crane bearings, woodworking and metalworking machine tools, mining machinery bearings, etc.

Bronze alloys in following grades:

No. 19; Cu 70, Sn 11, Pb 19; cast to specifications, for machining. In untreated state: Ts, 22,500-32,500 psi; comp str, 13,000-15.000 psi; ys, 18,000-24,000 psi; elong in 2 in., 14-17 per cent; impact str, 3.4 ft-lb (Izod); bhn, 62; sp gr, 8.98; nonmagnetic; resists corrosion caused by atmospheric conditions and fresh water; max cont. serv. temp 300-400 F; abrasion resistance, high. Used on mill bearings, gas and diesel engine bearings, excavating and pulverizing machinery, etc.

No. 25 (Plastic Bronze); Cu 75, Sn 5, Sb 19, Ni 1, cast to specifications for machining. In untreated state: Ts, 17,500-27,500 psi; comp str, 8-12,000 psi; ys, 13,750-19,750; elong in 2 in., 7-15 per cent; impact str, 5.2 ft-lb (Izod); bhn, 44; sp gr, 9.05; nonmagnetic; resists corrosion caused by diluted acids, atmospheric conditions, and fresh water; max cont. serv. temp, 300-400 F; abrasion resistance, high. For sleeve bearings used in pumps, electric motors, conveyors, fans, woodworking and lapping machines. For high speeds, light loads and no shock.

No. 27 (SAE 64); Cu 80, Sn 10, Sb 10, deoxidized with phosphorus; furnished in finished rods or bars and cast to specifications. In untreated state: Ts, 30-40,000 psi; comp str, 13-15,000 psi; ys, 16-22,000 psi; elong in 2 in., 10-30 per cent; impact str, 4.5 ft-lb (Izod); bhn, 58; sp gr, 8.75; nonmagnetic; resists corrosion caused by most acids, highly diluted, sea air, atmosphere and fresh water; max cont. serv. temp, 300-400 F; abrasion resistance, high. For sleeve bearings for most machinery and machine tools, valve and pump parts, general automotive bearings, appliances, etc.

No. 29 (SAE 67); Cu 78, Sn 7, Sb 15; cast to specifications. In untreated state: Ts, 19-29,000 psi; comp str, 13-15,000 psi; ys, 13,400-19,400 psi; elong in 2 in., 5-13 per cent; impact str, 5.6 ft-lb (Izod); bhn, 52; sp gr, 8.9; nonmagnetic; resists corrosion caused by 20 per cent solution hydrochloric acid. other diluted acids, atmospheric conditions, etc.; max cont. serv. temp, 300-400 F; abrasion resistance, high. For high-speed sleeve bearing applications with medium loads and soft shafts, acid-resisting bearing applications, fractional horsepower motors, etc.

No. 53 (SAE 62); Cu 88, Sn 10, Zn 2, cast to specifications. In untreated state: Ts, 31-41,000 psi; comp str, 13-16,000 psi; ys, 16-22,000 psi; elong in 2 in., 14-22 per cent; impact str, 8.5 ft-lb (Izod); bhn, 69; sp gr, 8.5; nonmagentic; weldability, fair; resists corrosion caused by atmospheric conditions, fresh water, highly diluted acids and sea water; max cont. serv. temp, 600-900 F; abrasion resistance, high. For gears and gear bushings, piston-pin and valve-guide bushings, steering-sector and hinge bushings, heavy-duty bearings, high-pressure air valves.

No. 72 (SAE 660); Cu 83, Sn 7, Sb 7, Zn 3; furnished in finished rods or bars, cast to specifications. In untreated state: Ts, 24-34,000 psi; comp str, 12-14,000 psi; ys, 11,600-17,600 psi; elong in 2 in., 12-22 per cent; impact str, 8.6 ft-lb (Izod); bhn, 56; sp gr, 8.7; nonmagnetic; resists corrosion caused by atmospheric conditions, fresh water and highly diluted acids; max cont. serv. temp, 300-400 F; abrasion resistance, high. For general machinery bearing applications.

JOHNSON (Rubber)—Johnson Rubber Co., Middlefield, O.

Molded and extruded rubber in any shape and quantity to specification.

K

"K" (Felt)—American Felt Co., Glenville, Conn.

Kapok felts to Air Corps Specification 16098, Types I and II. Material is corrosion-resistant, impact-resistant and noninflammable; for insulating, etc.

K-42-B (Ni-Co-Cr-Fe alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Ni 46, Co 20, Fe 12, Cr 18.75, Ti 2.25; furnished in rough bars or billets, rods or bars, wire, strips (coiled). and plates; for hot forging, stamping, turning, boring, welding, etc., also as sand castings. Resists corrosion caused by atmosphere and salt solutions; resists heat to 1200 C; ts, 127.100 psi; nonmagnetic; bhn, heat-treated 280. For applications where high strength at high temperatures is required.

KAISER ALUMINUM (Aluminum alloys)—The Permanente Metals Corp., Oakland 12, Calif.

Aluminum alloys 2S, 3S, 52S, 61S, 24S, 75S, roofing sheet, and utility sheet. Furnished in pig or ingot, straight and coiled strip, sheet, plate, roofing and siding.

KARBATE (Impervious carbon and graphite)—National Carbon Co., Inc., New York 17.

Corrosion-resistant materials. Impervious to seepage of liquids and gases under pressure. Possesses, among others, the following characteristics: Resistance to action of all acids, alkalies and salt solutions except those of a highly oxidizing nature, freedom from corrosion scale formation, resistance to thermal shock, and ease of machining. Impervious graphite base products have excellent thermal conductivity.

Available in the form of brick, plates, tile, pipe, fittings, valves, pumps, heat exchangers, towers and tower accessories such as bubble caps, trays, distributor plates, etc. Highly resistant to reaction with most materials encountered in chemical manufacturing plants and chemical processes at the concentrations and temperatures ordinarily employed.

KENNAMETAL (Tungsten-titanium carbides)—Kennametal, Inc., Latrobe, Pa.

Grade KM; tungsten-titanium carbide ($WTiC_2$) with other refractory metal carbides, and the optimum content of binder, furnished in powder metal, sintered form. Not heat-treatable; trans. str, 305.000 psi; comp str, 600,000 psi; ys, 305,000 psi; modulus of elasticity, 74,000,000 psi; impact str, .75 ft-lb (Charpy); endurance limit, 85,000 psi; hardness, rockwell C, 77.6; sp gr, 12.00; magnetic permeability, 3.00; resistance to corrosion, excellent at room temp; max cont. serv. temp, 1200 F; abrasion resistance, high. For pins and rollers, bushings, cam followers, bearings, chuck jaws, spindles, check-valve balls and seats, seaming rolls, etc.

Grade K3H; contains higher percentage of tungsten-titanium carbide ($WTiC_2$), and lower content of cobalt, than grade KM, consequently it is not quite as strong, but considerably harder. Trans str, 260,000 psi; comp str, 585,000 psi; Young's modulus of elasticity, 72,100,000 psi; hardness, Rockwell C, 79.6; sp gr, 11.10; magnetic permeability, 2.00. It resists oxidation and corrosion at high temperature better than other standard grades.

Grade K6; primarily composed of tungsten carbide with low content of cobalt binder; furnished in powder metal, sintered forms. Not heat-treatable. Trans. str. 225.000 psi; comp str, 900,000 psi; ys, 225.000 psi; modulus of elasticity, 94,300,000 psi; impact str, 0.75 ft-lb (Charpy); endurance limit, 85,000 psi; hardness, rockwell C, 80.6; sp gr, 15.10; magnetic permeability, 1.5; resistance to corrosion, excellent at room temp; max cont. serv. temp, 1200 F; abrasion resistance, high. For valve tappets, work rests, dovetail ways, wear-proofing strips, guides, bushings, needle valves, feeding fingers, serrated inserts for clamping devices, band-saw guides, etc.

Grade K12; straight tungsten carbide containing high percentage of cobalt binder; furnished in powder metal sintered forms; not heat treatable. Trans str, 350,000 psi; comp str, 660,000 psi; Young's modulus of elasticity, 77,000,000 psi; ys, 350,000 psi; impact str, about 1.00 ft-lb (Charpy); endurance limit about 100,000 psi; hardness, Rockwell C, 74.0; sp gr, 14.05; magnetic permeability, 3.7; resistance to corrosion excellent at room temperature; max cont serv temp, 1200 F; abrasion resistance, high. Applications similar to that of Grade K6, but where greater transverse strength is required. Most shock proof of all Kennametal grades.

Grade KE5; Special straight tungsten carbide-cobalt composition for extruded forms only. Hardness, 74.0 Rockwell C. Strength compares favorably with similar commercial grades. Produced in small rods or tubes of uniform cross section, suitable for use in gage elements, pins, pivots, feeding fingers, guides, and other small parts to which extruded forms can be adapted.

Grade KE7; Similar to KE5, but with greater hardness—77.6 Rockwell C.

KEYSTONE (Carbon steel)—Keystone Drawn Steel Co., Spring City, Pa.

Standard analyses cold-finished steel bars; carbon and alloy.

KGI (Glass)—Kopp Glass Inc., Swissvale, Pa.

Glass for marine, aviation, railroad and industrial applications. Types include technical glass, ultra-violet glass, heat-resisting glass, colored glass, crystal clear glass and opal glass.

KIDD (Steels)—Kidd Drawn Steel Co., West Aliquippa, Pa.

Flats, squares and special shapes in SAE grades, special alloys and open hearth and electric furnace tool steels. Analyses, characteristics and properties depend on grades of material, and according to customers' specifications.

KINITE (Tool steel)—H. Boker & Co., Inc., N. Y. C.

High-carbon, high-chrome air-hardening tool steel furnished in bars, castings, forgings. At Rockwell C 55, comp str is 300,000 psi; in cast form ts is 100,000 psi; in bar form, 200,000 psi. For dies, cams, slitting cutters, etc.

KLEENKUT (Chromium steel)—Heppenstall Co., Pittsburgh.

Tool steel containing C 2 and Cr 12. For sheet knives for cold shearing light material.

KOROSEAL (Synthetic rubber) — The B. F. Goodrich Co., Akron, O.

Flexible synthetic rubber; furnished in various consistencies from jelly to bone-like hardness; corrosion and shock-resistant; noninflammable; available in colors. Jelly is used for making molds for casting plastics; other compounds sold only as finished products. Superior to rubber in flexing, oxidation and penetration of moisture or gases; does not swell in oil. Available in molded and extruded forms and sheets; also applied as coating to paper and fabric.

KOVAR (Iron-cobalt-nickel alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Iron alloy containing 29 per cent nickel, 17 per cent cobalt and 0.3 per cent manganese. Ts, 89,700 psi; elong in 2 in., 25 per cent; ys, 50,500 psi; high resistance to amalgamation with mercury and withstands high thermal shock. For any application demanding vacuum-tight, metal-to-glass joints.

KRISTON "A" (Allyl ester thermosetting plastics)—B. F. Goodrich Chemical Co., Cleveland.

Furnished in crystals for casting and "contact" laminating. Has medium abrasion resistance and excellent chemical resistance. Max cont. serv. temp, 226 F (heat distortion point—66 psi fiber stress); flexural str, 14,000 psi; dielectric str, 1275 volts per mil; ts, 19,600 psi; impact str, 0.2 ft lb (Izod); furnished in natural clear form but can be made any color by fabricator; moisture absorption, low; machinability, fair. For viewing ports, nameplates and control knobs, by casting; and gear covers and other semistructural parts by laminating.

KYS-ITE (Thermosetting phenol-formaldehyde plastics)—Keyes Fibre Co., Waterville, Me.

K-100; furnished as finished moldings or for compression molding into parts. Abrasion resistance, low; resistant to boiling water, mild alkali, mild acid, and most organic solvents; dielectric str, 300-400 volts per mil; ts, 12,000 psi; comp str, 19,000-35,000 psi; flex str, 18,000 psi; moisture absorption, low; available in medium and dark shades; sp gr, 1.39-1.45; opaque; machinability, good. A high impact strength material coupled with lustrous finish it can be used as handwheels, small structural parts and other machine parts.

K-300; furnished same as K-100. Abrasion resistance, medium; resistant to boiling water, mild alkali, mild acid and most organic solvents; flex str, 7000-10,000 psi; dielectric str, 300-400 volts per mil; ts, 4500 psi; comp str, 16,000 to 25.000 psi; moisture absorption, low; available in medium to dark shades; sp gr, 1.36 to 1.42; opaque; machinability, good; for intricate shapes, housings, machine covers, business machine frames, etc.

L

LAMICOID (Thermosetting plastics laminate)—Mica Insulator Co., Schenectady 1, N. Y.

Phenolic and urea base thermosetting laminated sheets, rods and tubes; for machining and stamping into parts; can be furnished highly polished or satin; abrasion resistance, high; heat resistant to 250 F; moisture absorption, low; furnished in natural and black; impact-resistant; and has high dielectric strength. Used for gears, electrical and mechanical insulation, instruction charts, dials, etc.

LAMINAC (Unsaturated polyester resin)—American Cyanamid Co., New York 20.

For laminating or casting; furnished in various grades, Ts, 41,500 psi; comp str, 14.900 psi; imp str (flatwise), 33 ft lb (Izod); heat resistance depends on filler.

LAMINEER (Laminated plastics) — General Plastics Corp., New York 19.

Laminated plastics furnished in sheets for molding. Abrasion resistance, high; chemical resistance, excellent to mild acids and alkalies, alcohol and other solvents. Max cont serv temp, 250 F; noninflammable; dielectric str, high; moisture absorption, low; available in all colors, translucent and opaque; shatteproof; sp gr, 1.35; machinability, good. For any application requiring a combination of excellent resistance to chemical attack and abrasion with attractive appearance.

LAMITEX (Laminated phenolic plastics)—Franklin Fibre-Lamitex Corp., Wilmington, Del.

Thermosetting; furnished in sheets, rods or tubes in laminated form for machining, punching and screw machine work. Abrasion resistance high; heat resistant to 300 F; dielectric str, 150-750 volts per mil; ts, 7500-12,500 psi; comp str, 32,900-38,000 psi; moisture absorption, low; produced in black and natural; sp gr, 1.36-1.38; opaque. For all parts for radio, radar, communication systems, airplanes, vessels, tanks, trucks, automobiles, etc.

LA-SULPHITE 8640 (Manganese steel) — La Salle Steel Co., Hammond, Ind.

C 0.38-0.43, Mn 0.75-1.00, P. 0.04 max, S 0.04-0.06, Si 0.20-0.35, N 0.40-0.70, Cr 0.40-0.60, Mo 0.15-0.25. Furnished as finished bars for machining. Oil quench, 1525-1550, temper to desired hardness. For gears, splines, shafts, axles, etc.

LATERNEX (Arc welding electrode)—Metal & Thermit Corp., New York.

Produces deposit of 62-75,000 psi ts; 52-61,000 psi; elong in 2 in., 17-25 per cent. For guards, furnaces, tanks and other light-gage fabrication.

LAVITE (Ceramic)—D. M. Steward Mfg. Co., Chattanooga 1, Tenn.

For molding, machine, and extruding. Abrasion resistance, high; noninflammable; flexibility. low; dielectric str, 235 volts per mil; ts, 7200 psi; comp str, 96,000 psi; flexural str, 10,500 psi; moisture absorption, low; available in white, opaque. Can be used as a substitute for metal, fiber or plastics parts for mechanical use, such as washers, bushings, etc. Material can be machined.

LE ALLOY (Gray iron)—Lehigh Foundries Inc., Easton, Pa.

Gray iron, C 3.10-3.30, Si 2.10-2.30, Mn 0.60, S 0.15 max and P 0.25 max; furnished as sand castings. In untreated state: Ts, 35,000 psi min.; Bhn, 190-210; magnetic; max cont serv temp, 800 F; abrasion resistance, high. Primary usage is in pressure tight castings, also bearing surfaces, machine bases, valve bodies, pistons and cylinders.

LEDALOYL (Powder metal bearing alloys)—Johnson Bronze Co., New Castle, Pa.

Cu 83-85, Sn 9.5-10.5, Pb 2-4 and graphite 1.5 max; furnished in powder metal parts to specification. In untreated state: Ts, 7-12.000 psi; comp str, solid block, 57-70,000 psi; or for hollow section, 35-50,000 psi; elong in 2 in., 2-5 per cent; bhn, 35-45; sp gr, 6.4-7.2; nonmagnetic; weldability, fair; max cont. serv. temp, 275 F max; abrasion resistance, high. For bearing applications in all types of industrial and household equipment where lubrication is remote or likely to be neglected.

LEKTROKAST (Alloy iron casting) — Detroit Gray Iron Foundry, Detroit 7, Mich.

Furnished as sand castings to specifications. Ts, 40-50,000 psi; Bhn, 200-240; weldability, fair. Used for dies (mainly deep drawing), gears, etc.

LEKTROMESH (Metal plated screening)—C. O. Jelliff Mfg. Corp., Southport, Conn.

One-piece solid metal-plated screen made by electrodeposition; 100 ft rolls up to 35 inches in width of 40-120 mesh; smaller units in 150-400 mesh; furnished in nickel and copper. For strainers in fuel systems, dry-screening, etc.

LIGNOLITE (Lignin plastics)—Marathon Chemi-Co., Division of Marathon Paper Mills Co., Rothschild, Wis.

Lignin plastics, furnished in laminated sheet form; for machining and stamping into parts; abrasion resistance, high; resists corrosion caused by acids, water and oil; heat-resistant up to 176 deg F; flexibility, low; dielectric strength, 500-900 volts per mil; ts, 7500-12,000 psi; compressive, 25,000-35,000; moisture absorption, low; available in black only; sp gr, 1.4; opaque. Used in the electrical field as switchboards, switch-bases, barriers, terminal strips, insulating spacers, washers, nameplates, conveyor guides, cabinets, etc. Licensee: Haskelite Mfg. Co., Grand Rapids, Mich.

LIGNUM-VITAE (Tropical wood) — Lignum, Vitae Products Corp., Jersey City, N. J.

Natural tropical wood, 30 per cent volume is natural self-lubricating resin. Furnished in boards or logs for machining. Abrasion resistance, medium; resists corrosion caused by chemicals and light solutions; heat-resistant to 150 F; flexibility, low; moisture absorption, low; produced in natural colors; sp gr, 1.33; opaque; hardness, 3-4 Moh's scale; soluble in alcohol and acetone. For bearings, bushings, rollers, guides, etc., where lubrication is difficult or impossible.

LITHLEAD (Bronze)—Lithium Co., Newark 4, N. J.

Cu 64.6, Pb 35.4; furnished as ingots or pigs, rough bars or billets, as sand castings, permanent mold castings, precision castings, powder metal and finished bearings. Ts, 13,800 psi; comp str, 40.000 psi; elong in 2 in., 26.5%; Bhn, 27.1-28.4; nonmagnetic; max cont serv temp, 250 F. For bearings, brake linings, etc.

LMC (Copper-nickel steels)—Lewin-Mathes Co., St. Louis 2.

Pure electrolytic copper, brass and bronze mixtures, cupro-nickel; available in tubing. Used for all copper and brass tubing purposes.

LO-CRO (Stainless steels)—Crucible Steel Co. of America, New York.

Stainless steels in standard forms—Types 501 and 502. For property and application data on these, see "Stainless Steels" listing at end of this section.

LOF (Polished plate glass)—Libbey-Owens-Ford Glass Co., Toledo, O.

Heat-absorbing plate glass; furnished in sheet form; abrasion resistance, high; corrosion-resistant; heat absorbing; flexibility, medium; dielectric str, 0.204 kilovolts per mil; modulus of rupture. 6500 psi; moisture absorption, low; nonflammable; sp gr, 2.52; transparent: highly polished. For use where light transmission or vision is desired with insulation against solar radiation.

Polished plate glass; furnished in flat, bent and laminated form; in clear and colors; sp gr, 2.52; highly polished; high dielectric strength. Used for viewing windows.

LOGAN (Forging brass)—Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 58.5, Pb 1.9, balance Zn. Ts, 60-65,000 psi; red. of area, 40%; elong in 2 in., 40%.

LORD (Rubber-bonded-to-metal) — Lord Mfg. Co., Erie, Pa.

Rubber-bonded-to-metal, for a variety of uses including shear-type mountings for vibration isolation. Typical applications include aircraft, automotive, and marine engines; motors, pumps, compressors, general machinery, radio equipment, instruments, etc., where vibration is encountered.

LOUVERPLAS (Thermoplastic plastics) — The Doane Products Corp., Meriden. Conn.

Cellulose acetate, thermoplastic plastics in sheet form. In white and black and transparent; used for glare diffusing and for light control.

LUBRICO (Bearing bronze)—Buckeye Brass & Mfg. Co., Cleveland.

Cu 75, Pb 20, Sn 5. For bearings, bushings, etc. Shock-resistant; self-lubricating.

LUBRIK (Copper-tin-lead alloy) — Pittsburgh Brass Mfg. Co., Pittsburgh 1.

Cu 85, Sn 10, Pb 2½ and Zn 2½; furnished in rough bars or billets, for turning, boring, etc.; Bhn, 69. For heavy-duty bronze bearings. Hardened by addition of nickel.

LUCITE (Methyl methacrylate plastics)—E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

Methyl-methacrylate base, thermoplastic; furnished in powder for molding or sheets, rods and tubes for machining into parts. Parts injection molded or extruded have following characteristics: High abrasion resistance; unaffected by weak acids and alkalies; attacked by strong acids and alkalies; soluble in lower ketones and esters. Max cont. serv. temp, 216 F; flexural str, 19,600 psi (ASTM D 650-42T); dielectric str, 400 volts per mil; ts, 10,400 psi; comp str, 16,000 psi; impact str, 0.3-0.5 ft lb (Charpy); 0.4 ft lb (Izod); available in color; moisture absorption, low; transparent, translucent and opaque. For pumps, marine engine water-strainer sections, automatic feeder and lubricator parts, oscillator housing caps, glazing, etc.

LUKENS (Alloy steels) — Lukens Steel Co., Coatesville, Pa.

2 per cent nickel steel; in plates and spun and pressed heads. Untreated: Ts, 65-80,000 psi; ys, ½ of ts, elong in 2 in., 25%; Bhn, approx 140; for hot forging, stamping, hot or cold working, riveting, turning, boring, etc., into many types of machine parts where a high-tensile steel of good ductility for low temperature service is required.

Chrome-manganese steel; furnished same as above. Heat treated: Ts, 100-120.000 psi; ys, 65,000 psi min. Used principally in fan blades and fan rings or wherever any abrasion-resisting or high-stress properties are involved. For hot working.

3½ per cent nickel steel; furnished same as above. Untreated: Ts, 70-90,000 psi; ys, ½ of ts; elong in 2 in., 25%. Used where good resistance to impact is desired in parts operating in sub-zero temperatures.

Manganese-vanadium steel; furnished in same as foregoing. Untreated: Ts, 90,000 psi max; ys, 45,000 psi min; elong in 2 in., 20%; high-tensile steel with good welding properties. Used in construction of anti-aircraft gun mounts and carriages as well as military tank parts.

Nickel-clad, Inconel-clad, Monel-clad and stainless-clad (straight chromium and chromium-nickel types) steels are all clad metals or bimetals consisting of a light layer of corrosion-resistant nickel, Inconel, Monel or stainless steel bonded to a heavier base plate of steel. For corrosion-resistant parts. In plates and heads.

Chromium-nickel-molybdenum steel; furnished in plates and heads. Untreated: Ts, 90-110,000 psi; ys, 50,000 psi; elong in 2 in., 20%; Bhn, approx 195; magnetic; weldability, fair; abrasion resistance, high. For abrasion resisting parts at high temperatures where high stresses are involved.

Nickel-chromium steel; furnished in plates and heads. Untreated: Ts, 80-100,000 psi; ys, 50,000 psi, min; elong in 2 in., 20%; Bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts requiring good ductility.

0.50 molybdenum steel; furnished in plates and heads. Untreated: Ts, 65-80.000 psi; ys, ½ of ts; elong in 2 in., 25%; Bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts requiring high physical strength at high temperatures.

Chromium-copper-nickel steel; furnished in plates and heads. Heat treated: Ts, 65.000 psi, min; ys, ½ of ts; elong in 2 in., 25%; Bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts operating at low temperatures.

8½ per cent nickel steel; furnished in plates and heads. Heat treated: Ts, 90-110.000 psi; ys, 70,000 psi min; elong in 2 in., 20%; Bhn, approx 200; magnetic; weldability, good; abrasion resistance, medium. For parts operating at extremely low temperatures.

Chromium-molybdenum steel; furnished in plates and heads. Untreated: Ts, 70-90,000 psi; ys, 45,000 psi, min; elong in 2 in., 20%; Bhn, approx 160; magnetic; weldability, good; abrasion resistance, medium. For high-strength parts requiring good heat resistance.

Manganese-vanadium-titanium steel furnished in plates and heads. Untreated: Ts, 85,000 max psi; ys, 45,000 psi min; elong in 2 in., 20%; Bhn, approx 175; magnetic; weldability, good; abrasion resistance, high. For marine applications, principally.

LUMARITH (Cellulose acetate base plastics)—Celanese Plastics Corp., New York 16.

Cellulose acetate base, thermoplastic; furnished in sheets, powder or rods and tubes; powders for compression, injection and extrusion molding. Available in colors; ts, 3000-15,000 psi; dielectric str, 285-365 volts per mil (⅛-in. thickness); high polish; flexible; resistant to shock and corrosion. Used as interior electrical parts, instruments, aircraft lever knobs, electric insulation, steering wheels, automotive door and window handles, gas mask lens, etc.

Cellulose acetate base, thermoplastic; furnished in sheets and rolls or reels in thicknesses of 0.0007-0.20 for laminating, swaging, drawing or stamping into parts. Abrasion and corrosion-resistant; flexible; dielectric str, 700-2500 volts per mil; ts, 4500-11,000 psi; heat-resistant to 275 F; slow burning to nonflammable; transparent. Used for ammunition components, laminated slot insulation for motors; spirally wound tubing is used for insulating tool handles and interior electrical parts.

CA; cellulose-acetate base, specially developed for aircraft use in such applications as windows, cockpit enclosures, antennae housings, etc.; tough; has high clarity and optical uniformity; resistant to sunlight and can be heat-formed into three-dimensional shapes without surface impairment. Some of these materials are light stabilized having greater weather resistance; also for filtering out ultra-violet rays. It is abrasion-resistant.

LUMEN ALLOYS (Bearing bronzes) — Lumen Bearing Co., Buffalo 12 (Note: "Lumen Alloy," together with each of the following numbers and grades is a copyrighted term which should be used in specifying these materials. Thus, "Lumen Alloy No. 00A," etc.)

Nos. 00A and 00C; high tin bronzes for high compression bearing applications.

No. 1; zinc bronze for pressure castings including spur and bevel gears.

No. 2; zinc bronze for machine parts, bearings, etc.

No. 3; zinc bronze for mine service and paper mill machinery and bearings.

No. 4; phosphor bronze (leaded), for bearings.

No. 4 chill cast; for heavy-duty bearings, etc.

No. 4A; high-phosphorus bronze (leaded) for bearings on hard steel.

No. 5; general service casting alloy; red brass; for low pressure valve bodies, etc.

No. 7; phosphor bronze; uses include trolley wheels and castings to be nickel or chromium plated.

No. 9; manganese bronze for machine parts requiring strength, electrical conductivity, and high pressure.

No. 11-C; (sand cast) aluminum bronze; for miter, bevel gears and bearings subject to impact.

No. 11-C; (heat treated); ts, 65-100,000 psi; recommended where strength, corrosion and heat resistance are required.

No. 14; zinc bronze, babbitt backing; for valve bodies, etc.

No. 15; phosphor bronze; for worm wheels, bearings, etc.

No. 15 chill cast; for worm gears, nuts and bearings.

No. 15A; phosphor bronze (slightly leaded): for worm wheels, bearings, etc.

No. 15A; chill cast; for heavy-duty bearings and worm gear castings.

No. 20; super-manganese bronze; for machine parts requiring extra strength.

No. 31; for high-speed, low-duty bearings.

No. 33; for bearings, high-speed, low-duty.

No. 43; nickel-tin-bronze alloy for bearing, gears and nuts; abrasion-resistant.

No. 43 (Chilled); nickel tin bronze for bearings, worm gears and nuts with higher tensile strength than No. 43.

No. 48; nickel-phosphor-bronze; for bearings used with hardened steel, worm wheels, etc.

No. 48 chill cast; for bearings, worm gears, nuts, slippers, etc.

No. 54; phosphor bronze (leaded) for bearings and worm wheels for intermediate service.

No. 54 chill cast; for bearings, worm gears, nuts, etc.

No. 96; aluminum bronze, approximately 88 per cent Cu, 8.5 Al and 3.5 Fe; ts, 73,000 psi; ys, 25,000 psi; bhn, 114-121; sp gr, 7.7; and has medium abrasion resistance.

LUMITE (Industrial fabrics) — Chicopee Mfg. Corp. of Georgia, 40 Worth St., New York, N. Y.

Vinylidene chloride thermoplastics in woven fabric and braid; resistant to acid, most alkalies, solvents, oils and greases; max cont serv temp, 225 F; flexural strength, good; dielectric strength (volts per mil. inst.), 500; ts, 25-40,000 psi; available in all colors; sp gr, 1.72; available translucent and opaque. These are fabrics woven of Dow Chemical Company's Saran and are used for straining, filtering, sieving, conveyor belts, etc.

LUSTREX (Polystyrene molding plastics)—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

Flexural str, 12-14,000 psi; sp gr, 1.05; dielectric constant; (1 megacycle), 2.5-2.7; power factor (1 megacycle), 0.0001-0.0005; water absorption (24 hours), 0.04-0.05%. No effect from weak acids and bases or strong bases; is attacked by strong oxidizing acids. Is soluble in esters, aromatics, higher alcohols, chlorinated hydrocarbons. Available in any color desired, in opaque, translucent or transparent.

LUSTRON (Styrene thermoplastic plastics)—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

Styrene base; furnished in powder for molding into parts; abrasion resistance, fair; can be highly polished; corrosion-resistant; dielectric str, 500-700 volts per mil; ts, 6000-7000 psi; low moisture absorption; available in color; sp gr, 1.054-1.070; clear to opaque, Used for electrical insulating parts, etc.

LUZERNE (Hard rubber)—Luzerne Rubber Co., Trenton, N. J.

Hard rubber, thermoplastic; furnished in sheets, rods or tubes, for machining into parts; high polish; corrosion-resistant to acids and alkalies; dielectric str, 6 x 10^7 megohms constant at 28.8 C; ts, 3500-9000 psi; heat resistant to 120 F; available in some colors; sp gr, 1.24; comp str, 8000-12,000 psi. Used for electrical, chemical, medical and other parts requiring high dielectric strength.

M

M-13 (Magnesium-base die castings)—Precision Castings Co. Inc., Syracuse, N. Y.

Aluminum 9, manganese 0.13, zinc 0.6, silicon 0.5 max, with magnesium base; die castings; tensile strength, 33,000-34,000 lb per sq in.; yield point 21,000 lb per sq in.; elongation, 2 to 5 (3 av.) per cent in 1 or 2 inches; impact resistance, low; brinell hardness, 60; specific gravity, 1.81; nonmagnetic; corrosion resistance, fair; heat-resistant to 700 degerees Fahr.; abrasion resistance, medium.

MACHEMPITE (High strength castings)—Mackintosh-Hemphill Co., Pittsburgh.

C 0.3-1.25, Mn 1.25-1.75, Mo 0.25-0.75; furnished as castings. Ts, 85-125,000 psi; ys 65-100,000 psi; elong, 25-5 per cent; impact resistance, low; Bhn, 215-400; magnetic; weldability, good; abrasion resistance, medium. For gears, pinions, etc.

MAGICORES (Powder iron)—Henry L. Crowley & Co., West Orange, N. J.

High-frequency powdered iron cores for radio and electrical applications.

MAGNOLIA (Antifriction metal)—Magnolia Metal Co., Elizabeth, N. J.

Isotropic die cast bronze bar stock; Cu 80, Sn 10, Pb 10, and other alloys to suit conditions. Furnished in semifinished cored and solid bars, fully machined. Resists corrosion caused by acids; resists heat to 900 F; ts, 31,500 psi; comp str, 26,000; bearing properties, good; bhn, untreated, 70. Used for bearings.

AA Bronze: Isotropic die-cast bar stock for extremely tough bearing installations and for gears; bhn, 80; ts, 34,000 psi; elong in 2 in., 8 per cent. Furnished in cored and solid bars, fully machined.

Antifriction metal: Lead-base, less than 10 per cent of tin. For steady high speeds and heavy pressure. Keeps journals in good condition. Recommended also for electric motors above 10 hp. Bhn, 21.8.

MAIZEWOOD (Fiber insulation board)—Maizewood Insulation Co., Dubuque, Iowa.

Furnished in sheet form. Used as a sound deadener.

MAKEPEACE (Laminated precious metals)—D. E. Makepeace Co., Attleboro, Mass.

Laminated precious metals, consisting of any precious metals bonded to any nonferrous base metals, in strips (coiled), tubing, wire and sheets; for stamping, turning, boring, etc.

Sheet; available in any combinations of metals and ratio; single or double plate or strip. Can be produced as thin as 0.003-in.; in widths from ⅛-in. to 6 in.; and within tolerances of 0.0001-in. to 0.0002-in., depending on material. Available with fine mirrored finish suitable for fine precision parts or decorative pieces. Supplied coiled or flat, depending upon requirements, for any type of part.

Tubing; deep-drawn sheet; dimensional limits lie between approx. 0.015-in. OD to 2 in. OD, with wall thickness as small as 0.005-in., very close tolerances on wall thickness and diameters. Used in electrical industry, for electronic applications, radio parts, delicate instrument assemblies, etc.

Special shapes also available (rectangular, octagonal, or star-shaped, etc.) Rings, sleeves and jackets can be cut from laminated tubes.

Wire; diameters as fine as 0.005-in., depending on material, shaped for use. Available in any shape for instruments, for formed, plated springs, radio electronic parts and in chemical apparatus when corrosion must be prevented.

MALLIX (Pearlitic malleable iron) — National Malleable & Steel Castings Co., Cleveland.

For grate bars for sintering machines, elevator buckets, screen plates for pan mills and other castings subjected to heat, abrasion and shock.

MALLORY (High-copper and high-tungsten-base alloys)—P. R. Mallory & Co., Inc. Indianapolis.

3 Metal; a copper-chromium-lithium alloy; used extensively for spot, flash and seam welding cold-rolled steel, stainless steel, nickel alloys and Monel metal, silicon bronze alloys, zinc, nickel, silver and other materials employed in applications where a high-strength, high-conductivity material is required; available in rods, bars, strips and castings.

53B Metal; copper base alloy furnished in castings and forgings only; ts, 60-70,000 psi. Used for heavy-duty butt seam welding wheels, flash welding dies, bearings and current and heat-carrying members in electrical and other machinery.

73 Metal; rough and finished bars, sheets, castings and forgings; containing 95 per cent copper; resists sea water; ts, 110-170,000 psi. Used for bearings and bushings, vibrator arms, springs, spring washers and electrodes for projection welding.

100 Metal; rough and finished bars, castings and forgings, containing 95 per cent copper. Recommended for high loaded small gears, current-carrying bearings, springs and other details.

1000 Metal; predominantly tungsten; furnished in finished parts or blanks; ts, 100,000 psi; impact resistance, medium; hardness 32-40 rockwell C; sp gr, 16-9-17.1; nonmagnetic. Heat resistant up to 300 C; abrasion resistance, high. For small counter weights, gyroscope rings, etc.

MANGAWELD (Welding electrode) — Lincoln Electric Co., Cleveland.

Arc welding electrode that produces deposit of austenitic manganese-nickel-molybdenum steel. Suitable for hard facing austenitic manganese steel parts containing 11-14 per cent manganese, such as crusher parts, valves, turbine runners, pulverizer roll shafts, gathering and loading equipment.

MARBLETTE (Plastics cast phenolic resin)—The Marblette Corp., L. I. City, N. Y.

Furnished in sheet, rod and tube form; abrasion resistance, medium; decomposes in strong alkalies; is slightly affected by strong acids; noninflammable; ts, 8-12,000 psi; moisture absorption, low; produced in unlimited number of colors; sp gr, 1.30-1.32; available transparent, translucent, and opaque; machinability, good. Used for knobs, handles, various trim parts, etc.

MARBON "S" (Thermoplastics)—Marbon Corp., Gary, Ind.

Modified styrene thermoplastic furnished in granules for injection and compression molding; abrasion resistance, high; max cont serv temp, 120 F; flexural str (ASTM D 650-42T), 8000 psi; dielectric str (volts per mil inst.), 1035-1060; ts, 5400 psi; available in the color amber; moisture absorption, low; sp gr, 1.05; translucent; machinability, good.

MARCOLITE (Plastics laminates)—Marco Chemicals Inc., Sewaren, N. J.

Polyester thermosetting laminates having excellent chemical resistance, low moisture absorption, and good machinability.

MARVEL (Alloy steel)—Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.35, W 10.00, Cr 3.50, V 0.50, Si 0.25 and Mn 0.25; furnished in rough bars and billets, finished rods or bars, wire, sheet, plate, forgings and drill rod; for machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Comp str 400,000 psi; impact str, Charpy (unnotched), 40-60 ft-lb; hardness, rockwell C, 46 max; sp gr, 8.2; magnetic max cont. serv. temp, 1150 F; abrasion resistance high. For wearing parts used at high temperatures and subject to shock, high temperature springs, etc.

MAX-EL (Alloy steels)—Crucible Steel Co. of America, New York.

1-B; C 0.20, with high Mn and low Mo; excellent machining and uniformly in carburizing response. Used for automobile parts, machine tool parts, gages, sprockets, etc.

2B; C 0.40 and otherwise identical in analysis to 1-B. Used in "as-rolled" condition for machine tool spindles, lead screws, racks, worms, piston rods, etc.

3½; for heat-treated parts on machine tools, such as gears, arbors, spindles, etc.

4; this steel is used primarily for collets, pushers, rolls, spindles and toggle pins.

Also producers of high speed steels, tool steels and die steels under many trade names.

MAYARI R (Low-alloy, high-strength steel) — Bethlehem Steel Co., Bethlehem, Pa.

Meets requirements for SAE 950. Resists atmospheric corrosion and abrasion. Used for many types of light-weight construction. Furnished in sheets, plates, bars and structural shapes.

MAZLO (Magnesium alloys)—American Magnesium Corp., 2210 Harvard Ave., Cleveland.

Available in sand, permanent-mold and die castings, rolled sheet, extruded bar, shapes and structural sections, and forgings.

AM230; Al 10, Si 0.7, Mn 0.2, Mg remainder. Used for pressure die castings for parts requiring light weight and thin sections.

AM260; Al 9, Zn 1, Mn 0.2, Mg remainder. Heat-treatable alloy sand and permanent-mold castings. For moving parts on high-speed production equipment and wherever pressure tightness and good strength are needed. Good salt water resistance.

AM265; Al 6, Zn 3, Mn 0.2, Mg remainder. Used for high-strength sand castings requiring good chemical stability.

AM263; Al 9, Zn 0.6, Mn 0.2, Mg remainder. Used for pressure die castings for lightweight parts in portable or fast-moving equipment.

AM3S; Mn 1.5, Mg remainder. For extruded shapes, sand castings, and hammer forgings of moderate strength for uses requiring maximum salt water resistance. Suitable for fabricated articles such as aircraft oil tanks and cowlings.

AM-C52S; Al 3, Zn 1, Mn 0.2, Mg remainder. Used for extrusions of light weight. Good welding and forming characteristics and salt water resistance.

AM-C57S; Al 6, Zn 1, Mn 0.15, Mg balance. Used for extruded bars, tubes and for lightweight applications in general.

AM-C58S; Al 8, Zn 0.8, Mn 0.15, Mg remainder. Used for hot press forgings for parts under stress, especially for aircraft and aircraft engines.

AM59S; Al 10, Mn 0.15, Mg remainder. Used for extruded shapes in which highest possible hardness and yield strength in tension is required.

AM65S; Al 3.5, Sn 5, Mn 0.5, Mg remainder. Used for hot press forgings of moderate strength and lightness.

MCA (Alloying elements)—Molybdenum Corp. of America, Pittsburgh.

Ferro-Boron; alloying material in irons and steels. In castings its use gives increased strength and machinability, and in the case of malleable iron, ease of annealing.

Molybdenum; alloying element for use in steel and iron; imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper embrittlement, increases physical properties at elevated temperatures; molybdenum steel is easily welded and machined.

MD (Metal powders)—Metals Disintegrating Co., Inc., Elizabeth B, N. J.

Alloy aluminum antimony, bismuth, brass, bronze, cadmium, chromium, copper, iron, lead, manganese, nickel, silicon, silver, solder, tins, and zinc metal powders; compositions impossible to obtain by conventional methods. For powder metallurgy fabrication, welding rod manufacture, shot peening, blasting, abrasion, pigmentation, chemical uses.

MEADOL (Thermoplastic plastics)—The Mead Corp., Chillicothe, O.

Lignin thermoplastic furnished in powder for compression molding. Abrasion resistance, medium; max cont. serv. temp, 302 F; flexural str, 26,000 psi (Federal Spe. No. 1031); ts, 22,000 psi; comp str, 14,000 psi; impact str, 9.50 ft lb (Charpy); moisture absorption, medium; sp gr, 1.4; available in black; machinability, fair.

MECOBOARD (Thermosetting plastics) — Continental-Diamond Fibre Co., Newark 23, Del.

Phenol-formaldehyde, thermosetting; furnished in sheets, rods, and tubes for compression molding. Abrasion resistance, medium; max cont. serv. temp, 220 F; flexural str, 22,000 psi (ASTM D-229-42); dielectric str, 475 volts per mil; ts, 9500 psi; comp str, 31,000 psi; impact str, 6.5 ft lb (Izod); moisture absorption, low; translucent; machinability, good. Used for electrical insulation.

MEEHANITE METAL (Sorbo-pearlitic iron)—Meehanite Metal Corp., New Rochelle, N. Y. and foundries as listed hereunder.

Contains silicon, manganese, phosphorous, sulphur and carbon, composition depending upon mixture and physical constitution as determined by service requirements; twenty-four grades, some of which can be heat treated, and flame hardened, each having a separate and distinct combination of physical properties; available in cast form; for machinery and miscellaneous castings.

Foundries include the following: American

Brake Shoe Co., Mahwah, N. J.; Atlas Foundry Co., Detroit; Banner Iron Works, St. Louis; Barnett Foundry & Machine Co., Irvington, N. J.; E. W. Bliss Co., Toledo, O., and Hastings, Mich; H. W. Butterworth & Sons Co., Bethayeres, Pa.; Builders Iron Foundry, Providence, R.I.; Continental Gin Co., Birmingham, Ala.; M. H. Detrick Co., Newark, N. J.; The Elliott Co., Jeannette, Pa.; Farrel-Birmingham Co., Ansonia, Conn.; Johnstone Foundries, Inc., Grove City, Pa.; Otis-Fensom Elevator Co. Ltd., Hamilton, Ont.; E. Long Ltd., Orillia, Ont.; Valley Iron Works Inc., St. Paul; Greenlee Foundry Co., Chicago; American Laundry Machinery Co., Rochester, N. Y.; Cincinnati Milling Machine Co., Cincinnati; Cincinnati Grinders Inc., Cincinnati; Cooper Bessemer Corp., Grove City, Pa., and Mt. Vernon, O.; Crawford & Doherty Foundry Co., Portland, Oreg.; Florence Pipe Foundry & Machine Co., Florence, N. J.; The Newark Stove Co., Newark, O.; Fulton Foundry & Machine Co. Cleveland; General Foundry & Mfg. Co., Flint, Mich.; Stearns-Roger Mfg. Co., Denver, Colo.; Hamilton Foundry & Machine Co., Hamilton, O.; Kanawha Mfg. Co., Charleston, W. Va.; Lincoln Foundry Corp., Los Angeles; Koehring Co., Milwaukee; Henry Perkins Co., Bridgewater, Mass.; Pohlman Foundry Co., Buffalo, N. Y.; Rosedale Foundry & Machine Co., Pittsburgh; Warren Foundry & Pipe Corp., Phillipsburg, N. J.; Vulcan Foundry Co., Oakland, Calif.; Ross-Meehan Foundries, Chattanooga, Tenn.; Traylor Engrg. & Mfg. Co., Allentown, Pa.; Vancouver Engrg. Works, Vancouver, B. C.; Washington Iron Works, Seattle; Washington Machinery & Supply Co., Spokane, Wash.; Standard Foundry Co., Worcester, Mass.; Shenango-Penn Mold Co., Dover, Ohio.

MELMAC (Melamine formaldehyde plastics)—Plastics Division, American Cyanamid Co., New York 20.

1502; a cellulosic-filled, melamine formaldehyde plastics; thermosetting; furnished in granules for compression or transfer molding. Chemical resistance, good; flexural strength (ASTM D650-42T), 9000-10,000 psi; dielectric strength (volts per mil. inst.), 350-400 at room temperature; ts, 6000 psi; imp str, Izod, 0.40; moisture absorption, low; sp gr, 1.43; is opaque; machinability, good; coefficient of thermal expansion, 21-43 x 10^{-6}. Used for electrical insulation where arc resistance and track resistance are required.

1077; alpha-cellulose filled, melamine formaldehyde thermosetting plastics for transfer or compression molding. Abrasion resistance, high; chemical resistance, good; max cont serv temp, 220 F; is noninflammable; flexibility, low; dielectric strength (volts per mil. inst.), 310-315 at room temperature; ts, 7-8000 psi; comp str, 40-45,000 psi; moisture absorption, low; available translucent to opaque in all colors; is shatterproof; sp gr, 1.5; machinability, good; hardness, Rockwell E 100-110; coefficient of thermal expansion 20-57 x 10^{-6}. Used for housings, lighting reflectors, etc.

3020; melamine formaldehyde, thermosetting; furnished in particles for compression or transfer molding. Has high chemical resistance; max cont. serv. temp, 240 F; flexural str, 14,000 psi; dielectric str, 270 volts per mil; impact str 0.68 ft lb (Izod); available in white, green, blue, red, brown, black and ivory; moisture absorption, low; sp gr, 1.4; opaque. Used for electrical insulation where arc resistance is required (plus shock resistance).

MESH-TECH (Plywood)—Technical Ply-Woods, Chicago 1, Ill.

Consists of a thin three-ply panel, less than 1/16-in. thick. Faces are carefully chosen veneers of mahogany, walnut or maple. The core is a thin sheet of vulcanized material of high dielectric strength, tough, hard, dense, and light in weight. On completion panels are fed through a die and perforated. Has great strength for its weight. For radio grilles, air conditioning panels, interiors of buses, airplanes and railroad coaches where light weight is a factor.

METALINE (Bearing alloy) — R. W. Rhoades Metaline Co. Inc., Long Island City, N. Y.

Lubricating insert plugs of several diameters and lengths and in varied compositions for rendering bronze bearings and bushings oilless. Also bronze bearings complete in which Metaline plugs are inserted, furnished as finished bearings.

METAL & THERMIT (Welding electrodes)—Metal & Thermit Corp., New York City.

Stainless; Types 19-9, 347, 18-8, Mo, 25-20, 25-20 N, and 310 AC-DC. For welding food, chemical and refinery processing equipment, acid container linings, valve seats, turbine blades, heat exchangers, dies, etc.

Chrome-Moly Types; Type 2110 and 2115. For welding chrome-moly and other high-strength piping and pressure vessel cast fittings.

Copper-Aluminum (Bronze) Types; AB-12, AB-16, AB-20, AB-25, and AB-30. For built-up bearing surfaces, bronze casting repairs, repair of motor end rings, piston rods, pump parts, locomotive guides, parts of dissimilar materials, ship propellers, marine fittings, etc.

Copper-Tin (Bronze) Type; AB-57. Uses similar to those of above.

Types A, AWL, CW, FHP, F. HTS. M, MA, N, O, U, 90, 8015 Q, are for general machine-part fabrication and repair including drive shafts, auto springs, machine bases, etc.

METCO-WELD H (Powdered hard-facing alloy)—Metallizing Engineering Co., Inc., Long Island City, N. Y.

A "wire" composed of a powdered hard-facing alloy extruded with a plastic binder; applied by metal spraying, subsequent fusing with a fusing torch results in a coating alloyed to the base metal which is physically and chemically identical to hard-facing the same alloy applied by other methods. Hard facing is extremely resistant to abrasion and corrosion, has high strength and exceptional resistance to oxidation.

MICABOND (Mica material) — Continental-Diamond Fibre Co., Newark 23, Del.

A built-up mica material; furnished in sheets and tubing, for machining and forming into parts. Bonded together with shellac or synthetic resins to provide high dielectric and heat-and-moisture resistant properties. Available in two types; standard, for general use, and super for special applications requiring unusually high heat resistance and dielectric strength. Each type is produced in a number of grades for specific applications. Used for V-rings, washers, segments and various special shapes.

MICARTA (Thermosetting plastics) — Westinghouse Electric Corp., Trafford, Pa.

Melamine formaldehyde base and phenol formaldehyde base; furnished in laminated sheet, rods and tubes. Abrasion resistance, high; chemical resistance, good up to 15% solutions; max cont serv temp, 105-130 C; flexural strength (ASTM D 650-42T), 10,000-27,000 psi; dielectric strength (volts per mil inst.), 100-600; ts, 6,000-16,000 psi; comp str, 8000-40,000 psi; furnished in black and natural; is opaque; hardness, Rockwell M, 98-122. For variety of industrial applications such as gears, cams, panels, dials, etc.

MICHIGAN (Seamless tubing)—Michigan Seamless Tubing Co., South Lyon, Mich.

Cold-drawn; of standard carbon and alloy steels and of special alloys to customers' requirements. Available in rounds, squares and special shapes. For aircraft, pressure and mechanical uses.

MICRO-ROLD (Stainless steel sheet and strip)—Washington Steel Corp., Washington, Pa.

Precision cold rolled stainless steel sheet and strip up to 36 inches wide in Types 301, 302, 304, 430 in gages from 0.078 to 0.004 inch.

MIDVALE (Steels)—The Midvale Co., Nicetown, Philadelphia 40.

Forgings, weldless rings, any analysis (carbon, alloy or stainless steel), hardened and ground steel rolls, heat and corrosion resistant castings, cast-to-shape tool steel (Hi-C Hi-Cr) and bar steel (carbon, high speed and alloy tool steel), also stainless bars.

MIDVALOY Hi-C Hi-Cr (Cast-to-shape tool steel)—The Midvale Company, Nicetown, Philadelphia 40, Pa.

Furnished as sand castings. In annealed state, Bhn, 210-240; in hardened state, Rockwell C 59; weldability, poor; abrasion resistance, high. Machines readily; distorts very little and is nearly immune from cracking during heat treatment. Used wherever abrasion and wear resistance is an important requirement. Used for dies, blanking, beading, cams, cutting, drawing, extrusion and knurling tools.

MIN-OX (Heat-resisting castings)—The Binney Castings Co., Toledo 7, O.

Castings for molds, valves, plungers, neck rings and other necessary mold parts for production of glass. Also known as Binney Metal.

MISCO METAL (Stainless steels) — Michigan Steel Casting Co., Detroit 7. Mich.

For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

MM (Steel castings)—The Bonney-Floyd Co., Columbus 7, O.

C 0.25-0.35, Mn 1.20-1.40, Mo 0.15-0.25. Recommended heat treatment, quench at 1600 F in water; temper 500 F to 1325 F. Ts, 90,000-180,000 psi; ys 60,000-165,000 psi; elong in 2 in., 6-25%; Bhn, 179-420; sp gr, 7.86; magnetic; weldability, good; abrasion resistance, medium. Used for highly stressed machine parts.

MOCCASIN (Bronze alloys)—Moccasin Bushing Co., Chattanooga, Tenn.

Various bronze alloys furnished as rough castings, solid or cored bars, finished machined bars, and plain and special bushings.

MOGUL (Babbitt)—Federal Mogul Corp., Detroit.

Mogul alloy genuine babbitt; made from tin, antimony and copper, virtually lead free; hard, tough alloy; high tensile strength; suitable for die-cast and hand-poured bearings. Used for high-speed automobile and aircraft engine, steel and bronze back main and connecting-rod bearings, trucks, tractors, high-speed machinery, planers, etc.

Mogul bearing metal; general all-purpose babbitt for bearings requiring toughness. Used for machinery bearings, stationary gas engines, paper mill rolling mill, rubber plant and brick machinery.

407 nickel babbitt; varying slightly from Mogul genuine babbitt alloy. For applications where speed is fairly high and bearings are large, that is, 1/16th-inch or more in thickness. Used in woodworking machinery and other heavy-duty types.

408 special babbitt (copper-hardened); originally produced for electric railway armatures, now used for special bearing applications; has great durability and will stand up under hard wear. Used in motor pumps, motor shafts, rock crushers, forming presses.

Duro antifriction metal; while softer and less tough than Mogul bearing metal (above), compares favorably with lead-base general purpose babbitts. Used for flour mill, laundry, canning and bottling machinery, pump packing, slow-moving pulleys, etc.

Special "B"; a lead and antimony alloy; free of usual nonbearing ingredients. Used for slow-speed bearings and heavy line shafting.

MOLEX (Arc welding electrode) — Metal & Thermit Corp., New York 5.

For low-alloy, high-strength machine parts. Weld deposit: ts, 70-75,000 psi; ys, 57-66,000 psi; elong in 2 in., 22-31%.

Type R; arc welding electrode for use in shipbuilding, pipe fabricating, refineries, etc. Weld deposit: Ts, 63-75,000 psi; ys, 54-61,000 psi; elong in 2 in., 22-31%.

Type S; arc welding electrode for sheet metal fabrication in automotive work, storage tanks, railroad cars, road and farm machinery. Weld deposit: Ts, 71-75,000 psi; ys, 62-64,000 psi; elong in 2 in., 20-26%.

MOLEX (Molding plastics)—Molex Products Co., Chicago 6, Ill.

Bituminous and asbestos thermoplastics compound fabricated by injection and compression molding. Abrasion resistance, low; max cont serv temp, 186 F; dielectric str, (volts per mil. inst.), 205 after immersion in water 24 hours; ts, 2000 psi; comp str, 10,000 psi; produced in black only; moisture absorption, very low; sp gr, 1.61; is opaque; machinability, fair. For electric insulators, terminal blocks, receptacles, structural blocks, radiator valve wheels, etc.

MOLIN METAL (Aluminum-bronze alloys)—Dirilyte Co. of America Inc., Kokomo, Ind.

Furnished as permanent-mold castings and forgings to specifications.

No. 2; in untreated condition: Ts, 60,000 psi; elong in 2 in., 9 per cent; bhn, 130-140; weldability, good; abrasion resistance, high. For welding machine fixtures, bearings, etc.

No. 2½; In heat-treated condition: Ts, 62,000 psi; elong in 2 in., 3.5 per cent; bhn, 180-200; weldability, good; abrasion resistance, high. For welding machine fixtures, bearings, acid bath hooks, etc., which require higher hardness than that offered by Molin Metal No. 2.

No. 3; In untreated condition: Ts, 59,900 psi; elong in 2 in., 1 per cent; bhn, 200 to 220; weldability, fair; abrasion resistance, high. For wiping dies, die plates, welding machine fixtures, etc.

MO-LYB-DEN-UM (Alloying element)—Climax Molybdenum Co., New York 18, N. Y.

Alloying element for use in steel and iron. Imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper embrittlement, increases physical properties at elevated temperatures; molybdenum steel is easily welded and machined.

MOLYBDENUM PERMALLOY (Electrical seal)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A nickel-molybdenum-iron alloy of high permeability. Must be dry hydrogen annealed after fabrication. Furnished in finished rods or bars, coiled strip, wire, sheets. Used as a magnetic core material in special audio transformers, instruments and for magnetic shields.

MOLY-TELASTIC (Alloy cast steel)—The Falk Corp., Milwaukee, Wis.

C 0.30-0.40, Mn 1.00-1.50, Mo 0.15-0.25. Furnished in sand castings to specifications. In heat treated state, ts, 100,000-200,000 psi; ys, 70,000-160,000 psi; elong in 2 in., 25-12%; endurance limit, 45-50% of tensile strength; Bhn, annealed, 160; 200-400, heat treated. Used for gears, crusher parts, excavating equipment and similar heavy duty services.

MO-MAX (High-speed steel) — The Cleveland Twist Drill Co., Cleveland 14, Ohio.

A high-speed steel, in rough bars or billets, finished rods or bars, wire and sheets, for hot forging, turning, boring, welding, etc. Resists heat to 1100 F; high abrasion resistance; high ts; good bearing properties; sp gr, about 7.95; weldability, good; Bhn, untreated, 220; heat-treated 700. For use where great strength and wear resistance up to temperatures of 1000 F are required, such as gears, cams, guides, wearing plates, etc. Licensees are: Allegheny Ludlum Steel Corp., Atlas Steel Ltd. (Canada), Bethlehem Steel Co., Braeburn Alloy Steel Corp., Carpenter Steel Co., Columbia Tool Steel Co., Crucible Steel Co. of America, Henry Disston & Sons Inc., Firth-Sterling Steel Co., Halcomb Steel Co., Jessop Steel Co., Latrobe Electric Steel Co., The Midvale Co., Universal-Cyclops Steel Corp., Vulcan Crucible Steel Co., Simonds Saw & Steel Co., and Vanadium-Alloys Steel Co.

MONARCH (High-lead bronzes)—Monarch Alloys Co., Ravenna, O.

In several different grades, produced by water-chilled process; furnished in rough bars in 2-ft lengths. Good bearing qualities and good machinability. Also produce bronze and aluminum sand castings.

MONARCH (Rubber) — Hewitt Rubber Div., Hewitt-Robins Inc., Buffalo 5.

Rubber for hose, belting and packing. Can be furnished extruded or for molding. Abrasion resistance, high. For use wherever hose, belting or packing are required.

MONEL (High nickel-copper alloys)—The International Nickel Co. Inc., New York.

Monel Wrought Forms; various tempers of rod and bar, cold-drawn wire, hot-rolled plate, cold-rolled sheet and strip, and seamless tubing. Property ranges: Ts, 70-170,000 psi; ys, 25-160,000 psi; elong in 2 in., 50-1 per cent; bhn, 110-375. Corrosion resistance, high. For propeller shafts, pump shafts and rods, impellers, bolts, rivets, etc., orifice plates, tanks, electrical contact parts, springs, carburetor parts, strainers, screen, filters, etc.

Monel Castings; In untreated state: Ts, 65-90,000 psi; ys, 32-40,000 psi; elong in 2 in., 45-25 per cent; bhn, 125-150. Slightly magnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 800 F (under load); corrosion resistance, high. For pump casings, impellers, filter plates, valve bodies, trim, bushings, fittings. Widely used where corrosion resistance is an important factor as in laundry, pickling, tanning, marine, chemical, oil-processing, paint and food-processing equipment.

"K" Monel; furnished in rod and bar, strip and wire in various forms and tempers. Range of properties: Ts, 90-200,000 psi; ys, 40-145,000 psi; elong in 2 in., 45-2 per cent; bhn, 140-320. Corrosion resistance, high. For marine pump shafts, wearing sleeves, oil-pump drop and seat-valves, valve disks and pump rods, ball-bearing races, balls and cones, roller chain, link studs, check-valve balls, wire springs, etc.

"KR" Monel Wrought Forms; available in rod and wire only. Composition, same as "K" Monel. Has better machinability than K.

"R" Monel Wrought Forms; furnished in rod and bar, cold-drawn wire, hot-rolled plate, cold-rolled sheet and strip, seamless drawn tubing. Range of properties: Ts, 65-170,000 psi; ys, 25-160,000 psi; elong in 2 in., 50-1 per cent; bhn, 110-375. Corrosion resistance, high. Machinability, better than Monel. For parts requiring good corrosion and abrasion resistance combined with free-cutting qualities.

"H" Monel Castings; Untreated: Ts, 90-115,000 psi; ys, 60-80,000 psi; elong in 2 in., 20-10 per cent; bhn, 175-250; nonmagnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 800 F (under load); corrosion resistance, about same as Monel. For parts similar to those for which regular Monel is suitable, but where better abrasion and erosion resistance is required, plus higher strength, as for steam nozzles.

"S" Monel Castings; Heat treated: Ts, 110-145,000 psi; ys, 80-115,000 psi; elong in 2 in., 4-1 per cent; bhn, 300-375; nonmagnetic; weldability, good; abrasion resistance, high; max cont. serv. temp, 1100 F (under load); corrosion resistance, about same as regular Monel. Parts, similar to those for which regular Monel is suitable, but where top resistance to galling and erosion are needed, as for valve seats, etc.

MONIMAX (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A high nickel-molybdenum steel having good permeability at moderate flux densities. Used in low and intermediate density high-frequency cores.

MORAINE (Porous metal)—Moraine Products Div., General Motors Corp., Dayton, O.

Filtering and diffusing material, product of powder metallurgy in bronze, and other metals; provides high flow rates, low flow resistance; used in fuel and lubricating systems, instruments, breathers, burners, separators, etc.

MORGANITE (Carbon-graphite) — Morganite, Inc., Long Island City, N. Y.

Carbon-graphite, and carbon-graphite-metal mixtures; in finished rods or bars and plates, for turning, boring, molding, etc. Resists corrosion caused by any liquid handled industrially; resists heat to 700 F; good abrasion resistance; ts, 1000-3000 psi; comp str, 10-30,000 psi; ductility, low; sp gr, 2-2.15. Used for bearings, valves, seals, nonfriction slides, piston rings, etc.

MOSIL (Alloy steel)—Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.55, Si 1.90, Mn 0.85, Cr 0.25, Mo 0.33; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings, and drill rod; for permanent-mold casting, precision casting; machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: hardness, rockwell C, 62-63 max; magnetic; abrasion resistance, medium. For shanks, chisels, dogs, shears, etc.

HR (Plastic resins) — Marco Chemicals Inc., Sewaren, N. J.

Polyester thermosetting resin furnished in liquid form for castings. Has excellent corrosion resistance; low moisture absorption; and good machinability.

MRCO (Metal powders)—Metals Refining Co., Hammond, Ind.

40 RL; Cu 99.4; all passing in a 40-mesh sieve, not over 20 per cent passing a 200-mesh screen; has apparent density of 2.5 grams per cu cm. Used in commutator brushes, chemical porous filters, catalyzers, and pressed metal compositions.

100 RXA; Cu 99.4; all passing a 100-mesh screen; not over 45 per cent passing a 325-mesh screen; has apparent density of 2.7 grams per cu cm. Used in porous metal bearings, intricate pressed metal shapes, electrical commutator brushes, etc.

150 RXA; Cu 99.4; all passing a 150-mesh sieve, not over 75 per cent passing a 325-mesh sieve; has apparent density of 2.75 grams per cu cm. For same applications as 100 RXA.

200 RL; Cu 99.4; all passing a 200-mesh sieve, and not less than 85 per cent passing a 325-mesh sieve. Used in chemical equipment, special commutator brushes, porous bearing compositions; also has advantages for copper brazing and coating welding rods.

500 RL; Cu 99.4; all passing a 325-mesh sieve, and substantially all particles are less than 15 microns in diam. For use where extremely fine particle size is desired, in brazing and coating, as clutch facings, etc.

I-100; Fe 96 min; all passing a 100-mesh sieve; and 25-45 per cent passing 325-mesh sieve; has apparent density of about 1.8-2.0 grams per cu cm. For pressed parts such as clutch facings, gears, filters, etc.

I-120; Fe 96 min; all passing 100-mesh sieve and 30-50 per cent passing 325 mesh. Has apparent density of 2.3-2.5 grams per cu cm. Same uses as I-100.

I-147; Fe 96.5 min; all passing 40 mesh sieve and 10-20 per cent passing a 325-mesh sieve. Has apparent density of 1.8-2.0 grams per cu cm. Same uses as I-100.

I-247; Fe 97 min; apparent density 2.65-2.85 grams per cu cm; all passing a 40-mesh sieve with 10-20 per cent passing 325-mesh sieve; hydrogen-annealed for pressed ferrous metal compositions and electrical parts requiring high priority iron.

MUELLER 600 (Bearing metal)—Mueller Brass Co., Port Huron, Mich.

Cu 56-60, Pb 0.5 max, Mn 1.25-3.5, Al 0.5-2, Si 0.5-1.2, Fe 0.6 max, and remainder Zn. Sold as extruded and drawn, and rods and bars, and as die forgings from rod. Ts, 70-85,000 psi; ys, (½ per cent extension) 45-50,000; elong in 2 in., 20 to 10 per cent for die forgings. Sp gr, 8.071; conductivity about 12 per cent of copper; nonmagnetic; good corrosive resistance, against sea water. Used as low speed heavily loaded bearings as it withstands damage from lubricants carrying considerable sulphur compounds. Also used for high-speed bearings on hardened mating surfaces, cam faces and machine parts subject to wear, such as pump rods and shafts, and forged connecting rods for high-speed.

MULTIPLATE (Laminated shatterproof plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Multiple laminated plate glass, Vinyl plastic binder; furnished in cut sizes and shaped. Corrosion and abrasion resistance, high; shatterproof; transparent; highly polished. For protection against high velocity missiles.

MULTI-WEAVE (Special composite materials)—General Electric Co., Electronics Dept., Syracuse, N. Y.

Material made up by inter-weaving strands, strips, etc., of metals, plastics, wood, rubber, fabrics, etc., or combinations thereof. Produced to specifications. Used for ventilating grilles, decorative panels, gratings, bulkheads, air-conditioning grilles, guards, refrigerator trays, cigarette cases, display fixtures, etc.

MUMETAL (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A very high permeability nickel-copper-chromium-iron alloy, that must be very high-temperature, dry-hydrogen annealed after fabrication. Sold principally in form of sheet, strip, bar and laminations, also shields. For special electrical instruments and transformers requiring highest performance.

MUNTZ Metal (Copper-zinc alloy)—Revere Copper & Brass Inc., New York 17.

Cu 60, Zn 40; furnished in finished bars or rods, tubing, and sheet for machining, hot working, and arc, gas and resistance welding. In cold-worked state: Ts, 80,000 psi; ys, 60,000 psi; elong in 2 in., 5%; endurance limit (completely reversed bending), 25,000 psi; hardness, 85 Rockwell B; sp gr 8.39; max cont serv temp, 400 F. For condenser heads, perforated metal parts, valve stems, etc.

MYCALEX (Glass-bonded mica)—Mycalex Corp. of America, Clifton, N. J. Also General Electric Co., Chemical Dept., Pittsfield, Mass.

Furnished in sheets ⅛ to 1 in. thick, 14 x 18 in.; in rods 18 in. long, ¼ to 1 in. diameter. Abrasion resistance, medium; is unaffected by most liquids except acid solutions; max cont serv temp, 750 F; is nonflammable flexibility, low; dielectric str, (volts per mil inst.), 400; ts, 6000 psi; comp str, 35,000 psi; transverse str, 15,000 psi; moisture absorption, 0; produced in gray and brown; sp gr, 3; is opaque; machinability, good; Bhn, 50; coefficient of thermal expansion 101 x 10^{-7} in. per in. per degree C. For low-loss high-frequency insulators, terminal plates, precision moldings, arc and oil resistant parts.

N

NA, NA-1, NA-2 (Alloy steel castings)— National Alloy Steel Division, Blaw Knox Co., Blaw Knox, Pa.

Alloy steels having varying percentages of nickel and chromium.

NACO (Special cast steel)—National Malleable & Steel Castings Co., Cleveland.

For service where heavy blows and constant friction require a material that combines great strength, toughness and resistance to wear. Used in chains for steam shovel, dragline, draft gears, railway equipment.

NATIONAL (Carbon or graphite)—National Carbon Co., Inc., New York 17.

Molded, extruded or machined into practically any shape. Highly resistant to most acids, alkalies and solvents. Has low coefficient of thermal expansion and resists thermal shock. Good electrical conductivity. In graphitic form carbon possesses excellent lubricating properties and good thermal conductivity. Used for bearings, packings, electric current conductors, structural members and linings in the chemical and metallurgical industries. Available in blocks, brick, tile, beams, slabs, cylinders, and tubes.

NATIONAL (Fiber)—National Vulcanized Fibre Co., Wilmington, Del.

Converted cotton cellulose, chemically pure, tough horn-like material; furnished in hard or flexible form in sheets, rolls, tubes, rods and fabricated shapes; high dielectric and mechanical strengths; resistant to abrasion and shock; easily formed and machined; light in weight. Used for gears, valve disks, gaskets, washers, bobbin heads and electrical insulation, etc.

NATIONAL (Graphitic steel)—National Malleable & Steel Castings Co., Cleveland.

High-strength steel furnished in castings. Has medium abrasion resistance; ts, 75,000 psi min; can be flame hardened; avg bhn, 200. Used for automotive and other medium-size castings requiring high strength and good machinability.

NATIONAL (Metals)—National Bearing Div., American Brake Shoe Co., St. Louis 10.

Various nonferrous centrifugal and precision castings, babbitt metals and precision bearings. Castings produced to specification.

NATIONAL (Powder metal)—National Molded Products Inc., St. Marys, Pa.

Cu 90, Sn 10; furnished in powder; nonmagnetic; corrosion-resistant; heat-resistant to 400 F; abrasion-resistant. For bearings or intricate parts.

NATIONAL (Switch insulation)—National Vulcanized Fibre Co., Wilmington, Del.

Combination laminated Bakelite core with vulcanized fiber surfaces; available in sheets and fabricated shapes; high tracking (arc) resistance combined with rigidity and minimum warpage; high dielectric and mechanical strengths; low moisture absorption; easily stamped and fabricated. Used in switches to support and insulate current-carrying parts.

NATIONAL STANDARD (Wire, braided wire and tape)—National Standard Co., Niles, Mich.

Wire braids flat and tubular of steel or other metal.

Tapes and specialized wire products for tire beads, steam hose armor, reinforcement for oil well drilling hose, braided covering for flexible tubing.

Standard wire for reinforcing flat and V-belts.

Braided covering for electrical cables.

Drawn wire in small sizes down to 0.002-in. of steel, aluminum, brass, Monel, nickel silver, stainless steel, phosphor bronze and other alloys.

N-A-X (High strength low-alloy steel)—Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Mich.

9100 Series; C 0.1-0.7, Mn 0.6-0.75, P 0.040 max, S 0.05 max, Si 0.6-0.9, Cr 0.5-0.65, Mo 0.1-0.2, and Zr 0.05-0.15. Furnished in rough bars or billets, finished rods or bars, strips (coiled), sheets and plates, for forging, stamping, turning, boring, etc. Recommended heat treatment: Quench and draw—carburizing grades treated by regular conventional methods.

High tensile; C 0.12, Mn 0.70, Si 0.80, Cr 0.60, S 0.030, P. 0.025, and Zr 0.10. Furnished in rough bars or billets, finished rods or bars, strips (coiled), tubing, wire, sheets and plates for stamping and welding. No subsequent treatment needed after hot working. Good stability and ductility permit it to be cold-formed; good impact resistance; high fatigue resistance; good welding properties. Used for machine parts where high torsional properties, high tensile strength and resistance to fatigue and notch impact at normal and subzero temperatures are required.

NEILLITE (Phenolic plastics)—Watertwon Mfg. Co., Watertown, Conn.

Thermosetting material: furnished in powder form and granules for molding into parts; abrasion resistance, medium; resists corrosion caused by weak acid and alkali; dielectric str. 375-400 volts per mil; ts, 5500-7500 psi; comp str, 22,200-32,600 psi; moisture absorption, low; nonflammable; available in colors; shatterproof. For switch cases, spacers, gears, cams; knobs, etc.

NELOY (Cast steels)—National Erie Corp., Erie, Pa.

Medium manganese cast steel and medium manganese plus molybdenum alloy content cast steels; rough, finished, machined or flame hardened. High strength and hardness due to combination of alloying and special hardening. Has high abrasion resistance. Used for various applications in rolling mills and steel works equipment, overhead traveling cranes, power shovels, drag lines, etc.

NEOPRENE (Chloroprene synthetic rubber)—E. I. du Pont De Nemours & Co., Inc., Arlington, N. J.

Available for hose, wire, cable, sheets, tank lining, gaskets, packing, tubing, belting diaphragms, industrial truck tires and molded goods. Used as binder for cork and asbestos. Is employed to impregnate or coat canvas, duck or other fabrics. Strength, abrasion resistance, resilience and elasticity of rubber: resistance to deterioration from contact with oils, greases, gasoline, heat, chemicals, sunlight and ozone; corrosion-resistant; will not support combustion; low moisture absorption; ts 4000 psi; available in colors. Used for machine applications where rubber characteristics are required but where the product is to be subjected to deteriorating influences.

NEW JERSEY ZINC (Brass and copper powder metals)—The New Jersey Zinc Co., New York.

Brass Powders; all common brasses furnished in powder metal. Ts, 29-35,000 psi; comp str, 31-43,000 psi; ys, 8500-18,800 psi; elong in 2 in., 11-50%; impact str, 11-27 ft lb (Charpy); Bhn, 35-51.

Spherical Copper Powder; resists corrosion caused by oils and lubricants. Used for filters.

NEY-ORO-G (Gold-platinum-silver-copper alloy)—The J. M. Ney Co., Hartford, Conn.

In wire,sheets, coil strip and plate; for stamping, turning, boring, welding and soldering. Mechanical properties in heat-treated state: Ts, 160,000 psi; ys, 154,000; elong, 6 per cent; impact resistance, high; bhn, 280; non-magnetic; weldability, good; abrasion resistance, medium. For pivots, small bearings, springs and electrical contacts.

NICHROME-NICHROME V (High nickel-chromium alloy)—Driver-Harris Co., Harrison, N. J.

Ni 60, Cr 16, balance Fe, and Ni 80, Cr 20, respectively. High-temperature heat resistant and electrical resistant. Heating element material for domestic electrical appliances, electrical furnaces, ranges, also misc. elec. resistors. Castings for high-temperature furnace parts; also sheet, tubes, rod, strip and wire.

NICKELOID (Nickel bonded to zinc)—American Nickeloid Co., Peru, Ill.

Nickel bonding serves as rustproof, flexible and inexpensive white metal base. Available in variety of brillant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering, permitting drawing and forming without marring prefinish.

NI CLAD (Nickel clad copper rod and wire)—Alloy Metal Wire Co., Inc., Prospect Park, Pa.

Nickel clad copper wire, 34% cross sectional area is nickel shell covering, balance is copper. Furnished in finished rods or bars and wire. In cold worked state, ts, 80-90,000 psi; ys 20-30,000 psi; elong in 2 in., 10-29%; hardness, Rockwell B, 80-90, sp gr, 9; magnetic; weldability, good; max cont serv temp., 1000 F; abrasion resistance, medium.

NICLOY (Steel tubes)—The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

No. 3½; C 0.20 max., Mn 0.30-0.60, P.0.040 max, S 0.040 max, Si 0.35 max, Ni 3.25-3.75. Heat and corrosion-resistant tubing good creep strength. Nominal properties, heat treated, ts, 90,000 psi; ys, 60,000 psi; elong in 2 in. 40%; Bhn, 165; weldability, good. For low temperature equipment etc, weldability, good; corrosion resistant to alkaline and mixed organic acid solutions. For black liquor and alkali evaporation; also for sub-zero temperature service down to —320 F.

NICUITE (Bearing nickel-bronze)—A. W. Cadman Mfg. Co., Pittsburgh.

Nickel-bronze; Sn 10, Ni 3.5, Zn 2.5, trace of P, balance Cu; high comp str. For bearings operating at slow or medium speeds under extreme pressures.

NI HARD (Alloy steel castings)—International Nickel Co. Inc., New York.

Type 1 Regular Sand Cast; total C 3-3.6, Si 0.40-0.60, Mn 0.40-0.60, S 0.15 max, P 0.40 max, Ni 4.25-4.75, Cr 1.40-2.50. Ts 40-50,000 psi; Bhn, 550-650; magnetic; weldability, poor; abrasion resistance, very high. For parts such as grinding balls, ball and roll mill liners, pump parts, pug mill knives and other abrasion-resistant parts of mining, power, cement, ceramic, paint, coal, coke, and foundry equipment.

Type 1 Regular Chill Cast; composition same as above. Ts, 50-60,000 psi; Bhn, 600-725; magnetic; weldability, poor; abrasion resistance very high. For same type parts for which Type 1 Regular Sand Cast is suitable.

Type 2, High-Strength, Sand Cast; total C 2.90 max, Si 0.40-0.60, Mn 0.40-0.60, S 0.15 max, P. 0.40 max, Ni 4.25-4.75, Cr 1.40-2.50 Tc, 45-55,000 psi Bhn, 525-625; magnetic; weldability, poor; abrasion resistance, very high. Parts same as for the Regular Sand Cast Type, but for greater strength and toughness.

Type 2, High-Strength Chill Cast; Composition same as Type 2, Sand Cast; ts, 60-75,000 psi; Bhn, 575-675; magnetic; weldability, poor; abrasion resistance, very high. For parts same as those for which Regular Ni Hard is suitable, but where greater strength and toughness are required.

NIKRO (Alloy steel)—Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.70, Mn 0.55, Si 0.30, Cr 0.85, Ni 1.40, and Mo 0.40; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods; for machining, hot and cold working, stamping, drawing, brazing and forging. Hardness, rockwell C, 62 max; magnetic: abrasion resistance, medium. For spindles, etc.

NILVAR (Low-expansion nickel steel)—Driver-Harris Co., Harrison, N. J.

A 36% Ni steel having the lowest coefficient of expansion to 392 F of any alloy. Used for thermostatic controls in heating apparatus such as electric ovens, laboratory ovens, gas ovens, oil burners, and house heating apparatus.

NI-RESIST (Alloy steel castings)—International Nickel Co. Inc., New York.

Type 1; Total C 3.00 max, Si 1-2.5, Mn 1-1.5, Ni 13.5-17.5, Cu 5.5-7.5, Cr 1.75-2.5. As cast, ts, 25-30,000 psi; Bhn, 130-160; nonmagnetic; weldability, fair; abrasion resistance, medium; max cont serv temp, 1300 F; good corrosion resistance. For pipes, pump parts, heat exchangers, etc., where corrosion resistance, elevated-temperature resistance, or high electrical resistance is required.

Type 2; Total C 3.00 max, Si 1-2.5, Mn 0.80-1.5, Ni 18-22, Cu 0.50 max, Cr 1.75-2.5. As cast, ts, 25-30,000 psi; Bhn, 130-160. Possesses same properties and is used for same applications as Type 1.

Type 3; Total C 2.75 max, Si 1-2, Mn 0.40-0.80, Ni 28-32, Cu 0.50 max, Cr 2.5-3.5. Ts, 25-35,000 psi; Bhn, 120-150; magnetic: weldability, fair; max cont serv. temp, 1300 F. For corrosive applications or moderately high-temperature applications involving severe thermal gradients.

Type 4; Total C 2.60 max, Si 5.0-6.0, Mn 0.40-0.80, Ni 29-32, Cu 0.50 max, Cr 4.5-5.5. Ts, 25-35,000 psi; Bhn, 150-180; slightly magnetic; weldability, fair; abrasion resistance, medium; max cont serv temp, 1500 F. For food processing equipment where stain resistance is desired.

Type 5 (Minovar Iron); Total C 2.40 max, Si 1-2, Mn 0.40-0.80, Ni 34-36, Cu 0.50 max, Cr 0.10 max. Ts, 20-25.000 psi; Bhn, 100-125; magnetic; weldability, fair; for machine tool gages, scientific and optical instruments, glass molds, paper dies and equipment where low thermal coefficient of expansion is required.

NIREX (Acid-resistant alloy)—Driver-Harris Co., Harrison, N. J.

Ts, annealed, up to 95,000 psi; spring temper 180,000; supplied in finished rods or bars, wire, sheets and strip; also can be fabricated by sand casting. For use where corrosion and heat resistance, and spring properties will be useful.

NI-SPAN (Low and high expansion alloys)—International Nickel Co., Inc., New York.

Lo 42; Ni 40.5-42.5, Ti 2.2-2.6, C 0.06 max, Mn 0.30-0.60, Si 0.30-0.80, Al 0.40-0.80, P 0.04 max, S 0.04 max, Fe balance. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, and wire. Ts, 90-195,000 psi; ys, 40-165.000 psi; elong in 2 in., 30-5 per cent; Bhn, 140-385; is fairly magnetic; weldability, good. For low-expansion element in thermostats, measuring tapes, special springs, instrument-frame glass-to-metal seals, etc.

Lo 45; Ni 44.5-46.5, remainder same as Type Lo 42. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip and wire. Ts, 90-180,000 psi; ys, 40-150,000 psi; elong in 2 in., 30-5 per cent; Bhn, 140-370; is fairly magnetic; weldability, good. For same types of parts for which Ni Span Lo 42 is suitable.

Lo 52; Ni 51-53, balance same as for Type Lo 42. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, and wire. Ts, 85-150,000 psi; ys, 35-130,000 psi; elong in 2 in., 30-5 per cent; Bhn, 125-350; is fairly magnetic; weldability, good. For same types of parts for which Ni Span Lo 42 is suitable.

C; Ni 41-43, Ti 2.2-2.6, Cr 5.1-5.7, C 0.06 max, Mn 0.30-0.60, Si 0.30-0.80, Al 0.40-0.80, P 0.04 max, S 0.04 max, Fe balance. Furnished in rough bars and billets, finished rods and bars, straight and coiled strip, and wire. Ts, 90-200,000 psi; ys, 35-180,000 psi; elong in 2 in., 40-7 per cent; Bhn, 145-395; is less magnetic than Ni Span Lo types; weldability, good. A constant-modulus alloy for springs used in accurate scales, tuning forks, bourdon tubes, diaphragms for altimeters, strain gages.

Ni; Ni 28-30, Ti 2.2-2.6, Cr 8-9, C 0.06 max, Mn 0.30-0.80, Si 0.30-0.80, Al 0.40-0.80, P 0.04 max, S 0.04 max, Fe balance. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip and wire. Ts, 80-180,000 psi; ys, 35-130,000 psi; elong in 2 in., 30-8 per cent: Bhn, 140-370; nonmagnetic —130 to —320 F (depending on cold-work and heat treatment); weldability, good; abrasion resistance, medium. For high-expansion elements in thermostats, etc.

NI-SPAN C (Ti-Cr-Ni alloy)—H. A. Wilson Co., Newark 5, N. J.

A titanium-chromium-nickel alloy having a constant modulus, adjustable through heat treatment.

NI-TENSYLIRON (Nickel alloy iron)—International Nickel Co. Inc., New York.

Ni 1-6, total C 2.5-3.15, Si 1.2-2.75, Mn 0.5-0.9. For machine tool castings, diesel engine housings, cylinder blocks, pistons, etc.

NITRALLOY (Nitriding steel)—Nitralloy Corp., New York.

Controls nitriding process and licenses under which alloy is produced. A chromium-molybdenum-aluminum steel capable of developing extreme hardness through nitriding; for cams and camshafts, gears, pump parts, splined shafts, cylinder liners, etc. Licensees include Allegheny Ludlum Steel Corp., Bethlehem Steel Co., Crucible Steel Co. of America, Firth-Sterling Steel Co., Grede Foundries, Inc., Republic Steel Corp., Rotary Electric Steel Co., The Timken Roller Bearing Co., Vanadium Alloys Steel Co., Copperweld Steel Co., Atlas Steels Ltd., The Babcock & Wilcox Tube Co., and Carnegie-Illinois Steel Corp.

NITRON (Cellulose nitrate plastics)—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

Thermoplastic; furnished in sheets, or in laminated form for machining, molding, stamping, swedging or blowing (steam) into parts; corrosion resistant; translucent; available in colors; flexible; dielectric str, 600-1200 volts per mil; ts, 5000-10,000 psi; low moisture absorption. Used for sight glasses, safety handles and structural models for strain study.

NIXON C/A (Cellulose acetate plastics)—Nixon Nitration Works, Nixon, N. J.

Furnished in sheets, rods, tubes and granules for injection and compression molding and extruding. Abrasion resistance, high; soluble in ketones and esters, slightly soluble in alcohol, little affected by hydrocarbons. Max cont serv temp. 160 F; flexural str, 4-15,000 psi (ASTM D 650-42T); dielectric str, 290-400 volts per mil; ts, 4-11,000 psi; comp str, 10-30,000 psi; impact str, 0.25-0.35 ft lb (Charpy), and 1.0-4.2 ft lb (Izod); available in colors; moisture absorption, low; sp gr, 1.27-1.56.

NIXON C/N (Cellulose nitrate plastics)—Nixon Nitration Works, Nixon, N. J.

Thermoplastic; for molding, machining, stamping and forming into parts. Abrasion resistance, medium; resists corrosion caused by water, hydrocarbons, diluted alkalies and acids; heat resistant to 160 F; flexible; dielectric str, 300-500 volts per mil; ts, 6000-9000 psi; comp str, 20-30,000; moisture absorption, low; produced in color; shatterproof; sp gr, 1.39-1.45; transparent, translucent and opaque; machinability, good; Bhn, 8-11. For handles, knobs, nameplates, etc.

NIXON E/C (Ethyl cellulose plastics) — Nixon Nitration Works, Nixon, N. J.

Thermoplastic; furnished in sheet, rods, tubes, and granules for injection molding, blow molding, and extruding. Abrasion resistance, medium; is affected slightly by weak acids; decomposes in strong acids; max cont serv temp, 140-200 F; flexural str (ASTM D 650-42T), 9000-10,000 psi; dielectric str, (volts per mil inst.), 470-550; ts, 2,500-8000 psi; unlimited color possibilities in transparent, translucent and opaque; moisture absorption, low; sp gr, 1.08-1.18; machinability, good; good dimensional stability; good toughness and strength; low-temperature shock resistance. For motor housings, electrical appliances, etc.

NOVO SUPERIOR (High-speed steel)—H. Boker & Co., Inc., N. Y. C.

An 18-4-1 (W, Cr, V) steel with maximum red hardness and wear resistance. Used for punches, broaches, cutters, knives, reamers, drills, etc.

NUBRAZE (Silver brazing alloys)—Sherman & Co., New York 13, N. Y.

Contains silver, copper, cadmium and zinc in varying percentages; furnished in straight and coiled strip, wire and powder metal. For repairing broken tool bits, hobs, milling cutters, etc. Also for mounting carbide tips.

NUREX (Alloy steel castings)—National Malleable & Steel Castings Co., Cleveland.

A chromium-manganese-carbon alloy furnished in castings. Resists corrosion caused by dilute aqueous solutions and acids (except phosphoric). Resists heat to 1700 F. Abrasion-resistant. Used for mill balls, lining and similar purposes.

NYLON (Thermoplastics plastics)—E. I. Du Pont de Nemours & Co., Inc., Arlington, N. J.

Polyamide thermoplastic, furnished in flake for extrusion and wire coating, as monofilament for bristles, tennis string, fishing leaders, etc, and in powder for molding. Injection molded parts have high abrasion resistance; max cont serv temp. 380 F; flexural str, 13,000 psi (ASTM D 650-42T); dielectric str, 385 volts per mil; ts, 10.500 psi; comp str, 18,000 psi; impact str, 0.94 ft lb (Izod); produced in black, red and natural color; sp gr, 1.14; translucent and opaque. Used for valve seats, bearings, gears and coil forms.

O

ODIS (Staybolt wrought iron)—Old Dominion Iron & Steel Corp., Richmond 3, Va.

Solid and hollow rolled, furnished in rods or bars for cold working. Has high ductility, high corrosion resistance and good machinability. For staybolts of all types.

OHIO (Carbon and carbon-graphite)—Ohio Carbon Co., Cleveland 11.

Carbon furnished in rods or plates. Abrasion resistance, medium; chemical resistance, high; max cont. serv. temp, 400-500 F; flexibility, low; ts, 2275 psi; comp str, 7-9000 psi; transverse str, 6500 psi or more; moisture absorption, low; available in black and natural; machinability, fair. For bearings such as slow speed bearings and thrust bearings, seals for pumps, etc.

OHMALOY (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A steel for high electrical resistance applications, such as motor starters, crane motor controls, and mine locomotive controls. Available in all forms. Approx. analysis—Cr 12, Al 4½, Fe bal.

OHMOID (Phenolic plastics)—Wilmington Fibre Specialty Co., Wilmington, Del.

Thermosetting; furnished in laminated sheets, rods and tubes, for machining or stamping into parts; dielectric strength, 200-700 volts per mil; moisture absorption, 2 per cent; insoluble in ordinary solvents; high polish; corrosion-resistant; ts, 10-14,000 psi; heat resistance, 250-300 F. Used for electric and machanical insulation.

OILITE (Powder metals)—Chrysler Corp. Amplex Div., Detroit 31.

Oilite bronze bearings; heavy duty self-lubricating precision bronze bearings; 30% oil by volume. Wide ranges of sizes in plain, flange, thrust, self-aligning bearings. Used extensively in aircraft, motor vehicles, farm implements, home appliances, electrical equipment, textile machinery, food processing and packing machines, etc. Available in cored, bar, and sheet stock.

Super-Oilite; a porous, oil-cushion, extreme-pressure, self-lubricating non alloy bearing. Allowable static bearing load, 30,000 psi. High oil content, strength and ductility. Furnished in finished bearings and in cored, solid, and plate stock.

Super-Oilite 16; a porous, oil-cushion, extreme high pressure self-lubricating bearing. For high loads at low velocities. Extreme hardness combined with high oil content, for static bearing loads up to 10,000 psi.

Iron Oilite; a porous, pure iron (copper free), oil-cushion, self-lubricating bearing. Resistant to chemical and corrosive actions, particularly of sulphur and its compounds. Used especially for bearings in pumps.

Aluminum Oilite; a porous, light-weight, oil-cushion bearing. Eliminates galvanic action with surrounding aluminum housings. For aircraft controls and wherever lightness is important.

Oilite Machine Parts; eliminate machining. Made by powder metallurgy processes from nonferrous and ferrous alloys. Wide range of physical properties. Reduce tool-up time and cost.

Oilite Filter Materials; for filtering, metering, diffusing, flame-arresting, and other uses. High flow with low resistance. Calibrated porosity. From variety of metals and alloys.

Oilite Friction Materials; powder metallurgy products. High heat conductivity. Uniform friction qualities. Resistant to high temperatures and to glazing and wear. For clutch, brake, and other applications.

OILWAY (Die steel)—H. Broker & Co., Inc., New York.

Die steel containing C 0.94, Si 0.33, Mn 1.23, W 0.57, and Cr 0.44. Furnished in bars, drill rods and forgings. As cast, ts is 150,000 psi; in bar stock form, 200,000 psi. Comp str, 350,000 psi. For all types of dies, gages, reamers, broaches and punches.

OLD DOMINION (Staybolt wrought iron)—Old Dominion Iron & Steel Corp., Richmond 3, Va.

Solid and hollow-rolled. Has high corrosion resistance, high ductility, and good machinability. For various types of staybolts.

OLDS BEARING BRONZE (High leaded nickel-bronze)—Olds Alloys Co., Southgate, Calif.

Furnished in ingot form and sand castings; in heat treated state; ts, 38,000 psi; ys, 28,000 psi; elong in 2 in., 8-12%; impact str (Izod), 5-7 ft-lb.; sp gr, 9.2; nonmagnetic; weldability, fair; max cont serv temp, 400 F; abrasion resistance, medium to high. For general bearings subjected to heavy loads and high speeds.

OLDSMOLOY (Cr-Ni-Mo-bronze)—Olds Alloys Co., Southgate, Calif.

Furnished in ingot form and sand castings to specification; in normalized state; ts, 80,000 psi; ys, 47,000 psi; elong in 2 in., 15-20%; Bhn, 160-170; sp gr, 8.4; nonmagnetic; weldability (gas), good; max cont serv temp, 500 F; abrasion resistance, medium to high. Used for parts in food and and chemical machinery of all kinds, for heavily loaded bearings, pintle and detachable chains.

OLYMPIC (Bronze)—Chase Brass & Copper Co., Waterbury 91, Conn.

Type A; Cu 96, Si 3, Zn 1; ts 55-150,000 psi; Bhn, 70-200. Resists corrosion due to saline, acid and alkaline solutions. Used for welded structural parts, bolts, nuts, tubing, tie rods, etc.

Type B; Cu 97.5, Si 1.5, Zn 1; ts, 45-90,000 psi. Resists corrosion due to saline, acid and alkaline solutions. Used for bolts, nuts, pipe and tubing.

ORCO (Natural and synthetic rubbers)—Ohio Rubber Co., Willoughby, O.

All natural and synthetic rubbers furnished in sheet, channel, strip, tubing and special shapes. Also molded and extruded parts and rubber-to-metal parts to specification.

OREIDE 0.5% (Tin brass)—Scovill Mfg. Co., Waterbury, Conn.

Cu 89.5, Sn 0.5, balance Zn; available in strip, rod, wire and tube. Has excellent cold working characteristics and a gold color making it particularly suitable for costume jewelry, novelties, buckles, clips and other commercially fabricated products. Ts 63,000 psi (hard); density 0.318 lbs/cu in.; recommended annealing temperature range, 800-1350 F (525-725 C).

ORNAMETL (Wood veneer on steel)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Veneer on steel, is furnished in sheets for stamping, rolling and pressing. Seminflammable; moisture absorption, low; available in mahogany, walnut and birch veneers; shatterproof; machinability, good. Used for airplanes, buses, street cars, railways, etc.

OSTUCO (Precision tubing)—Ohio Seamless Tube Co., Shelby, O.

Seamless and electric-welded. Formerly known as Ohio Specialty Quality tubing.

OTISCOLOY (Special high-tensile steel)—Jones & Laughlin Steel Corp., Pittsburgh 30. A high-tensile steel, light in weight, good weldability and formability; resistant to abrasion and atmosphereic corrosion. For use in cars, trucks, buses, mine cars, etc.

OXWELD (Welding rods)—Linde Air Products Co., New York 17.

No 6 C. M. steel rod; for making high-strength welds in base materials which are to be heat-treated after welding such as aircraft parts containing carbon manganese, silicon, molybdenum and chromium. Can also be used for building-up hard and wear-resisting surfaces on pressure rolls, shovel teeth, grinding mills and similar applications.

No. 32 C. M. S. steel rod; for high-strength and high-speed welding of pressure vessels, tanks and steel pipe. This rod produces welds with a tensile strength of between 75,000 and 90,000 psi. Speed of application, which reduces gas consumption, is a feature of this rod.

No. 14 drawn aluminum rod; for sheet aluminum, and aluminum-manganese alloys. Conventional drawn aluminum rod for welding pure sheet aluminum where high strength is not required.

No. 25M flux-coated bronze rod; precoated with Brazo flux during manufacture. Combines qualities of standard 25M with advantages of correct fluxing. Pre-coating assures the right amount of flux and speeds up welding. Flux adheres tightly to rod and does not spall off ahead of flame. Not affected by exposure to weather.

No. 31T bronze rod; for building-up wear-resisting surfaces subject to heavy loading, especially where elevated temperatures are encountered. Rod is harder than No. 25M but less ductile. It is preferable to No. 25M for motion parts, such as pistons, piston rods, guides, slides valves and similar parts.

OXYCUTTEND (Electric-arc cutting rods)—Arcos Corp., Philadelphia 2, Pa.

Coated tubular rod for cutting metals by the Oxyarc process. Cuts all metals using electric arc and stream of oxygen to achieve fabrication. For housings, trim, guards, etc. cutting.

P

PAGE (Steel wire)—Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.

Low and high-carbon steel wire; also Ingot iron wire and stainless steel wire, furnished in various strengths and hardness numbers. Also same analyses in shaped wire for special purposes.

PAINTGRIP (Bonderized cold rolled steel)—American Rolling Mill Co., Middletown, O.

Iron or steel shafts or coils mill-treated with an electrolytic "flash" of zinc and then bonderized. Will draw, form, weld and solder readily. Eliminates bonderizing after fabrication. For housings, trim guards, etc.

PAISLEY (Adhesives) — Paisley Products Inc., Chicago 16, Ill.

Wide variety of adhesives including glues, pastes, resins, cements, etc.

PALINEY (Palladium - platinum - silver - copper-nickel alloy)—The J. M. Ney Co., Hartford, Conn.

No. 6; in wire, sheets, coiled strips, and plates for stamping, turning, boring, welding and soldering. Mechanical properties in heat-treated state: Ts, 170,000 psi; ys, 127,000; elong, 15 per cent; bhn, 270; sp gr, 10.9; nonmagnetic; abrasion resistance, medium. Used for pivots, small bearings, springs, electrical contacts etc.

No. 7; similar to No. 6 in analysis with the addition of gold; available also in the same form. In heat-treated state: Ts, 180,000 psi; ys, 148,000; elong 9 per cent; impact resistance, high; bhn, 280; sp gr, 11.9; nonmagnetic; weldability, good. For same uses as foregoing.

PAMUDO (Plywood)—Pacific Mutual Door Co., Plywood Div., Tacoma 1, Wash.

Douglas fir plywood, furnished in stock sheet sizes and sizes to specifications. Has high chemical resistance, high impact resistance and high tensile strength. (U. S. Commercial Standards CS-45-45). For various industrial applications and uses in conjunction with metal parts.

PANELYTE (Laminated plastics)—Panelyte Division, St. Regis Paper Co., New York.

Laminated resinous thermosetting plastics in sheets, rods, tubes, structural forms and molded shapes supplied in fabric, paper, wood or asbestos base grades; parts fabricated or semifabricated to print. Various grades characterized by high strength, light weight, good electrical properties, excellent heat resistance, and freedom from odor. Unaffected by solvents, dilute acids and alkalies. Outstanding machinability, punchability and dimensional stability. Used in aircraft for propellers and propeller parts, air deflectors for engines, skin, fairings, inter-compartment doors and for high "EI" molded flooring. Also for radio and other electrical insulation applications, gears, pinions and nonstressed or semistressed structural parts, and in refrigeration for trim and structural parts.

PAR (Alloy steel sand castings)—Crucible Steel Casting Co., Cleveland.

No. 2; C 0.25, Si 0.45, Mn 0.65, Ni 2.75, Cr 1.75, Mo 0.3, P 0.05; sand castings. In heat-treated state: Ts, 100,000 psi; ys, 75,000 psi; elong, 20 per cent; impact resistance, low; bhn, 230; magnetic; abrasion resistance, high; can be heat-treated for good wear resistance.

No. 6; C 0.2 max, Si 0.85, Mn 0.7, Cr 25, Ni 12; sand castings. In heat-treated state: Ts, 80,000 psi; ys, 42,000 psi; elong, 32 per cent; impact resistance, high; bhn, 165; sp gr, 7.5; nonmagnetic. Resists corrosion caused by sulphur dioxide; heat-resistant to 2000 F; abrasion resistance, low. Used for furnace parts and machine parts where corrosion resistance is desired.

No. 7; C 0.3, Si 0.85, Mn 0.7, Ni 35, Cr 15; sand castings. In untreated state: Ts, 73,000 psi; ys, 41,000 psi; elong, 7 per cent; impact resistance, low; bhn, 170; sp gr, 7.8; nonmagnetic; corrosion resistant; good for hydrochloric acid solution; heat-resistant to 2000 F; abrasion resistance, low. For heat-treating furnace parts, carburizing boxes, etc.

PARAPLES (Plastics resins)—Resinous Products & Chemical Co., Philadelphia 5.

Furnished in liquid form for casting and laminating; abrasion resistance, high; has excellent resistance against acids, alkalies, solvents; is transparent; machinability, good.

PAR-EXC (Alloy steel)—Vanadium Alloy Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.50, Si 0.28, Mn 0.20, W 2.00, Cr 1.65 and V 0.25; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods; for machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Hardness, rockwell C, 58 max; magnetic; weldability, fair; max cont. serv. temp, 600-800 F; abrasion resistance, medium. For wearing parts requiring a hard surface and a very high-strength core.

PEARL CITY (Plywood)—Pearl City Plywood Co. Inc., Jamestown, N. Y.

Plywood and veneers for cold-press gluing, furnished in sheet form. Nonflammable; flexibility, as required; moisture absorption, low; produced in all woods; machinability, good. For treads, etc.

PEERLESS (Fish paper insulation)—National Vulcanized Fibre Co., Wilmington, Del.

Converted cotton cellulose, chemically pure, fish paper insulation; furnished in sheets and rolls; high dielectric strength combined with toughness, springiness and good bending properties. Used extensively for generator and motor insulation applications.

PENACOLITE G-1131 (Adhesive) — Penacolite Div., Pennsylvania Coal Products Co., Petrolia, Pa.

Resorcin resin adhesive, capable of curing at room temperatures, providing durable, waterproof bonds. Recommended for bonding of all cellulosic materials, most of the thermoplastic and thermosetting materials, as well as natural and some synthetic rubbers. Can be used with pressures as low as 25 psi. Recommended for use where strength and proof against water, weathering and dampness are required.

PENN (Bronze welding rod)—Titan Metal Mfg. Co., Bellefonte, Pa.

Used where high-strength ductile welds are desired. Resists abrasion.

PENN (Fiber)—Penn Fibre & Specialty Co., Philadelphia 34.

"B" Board; pulp board, furnished in sheets and strips, for stamping and forming. Abrasion resistance, low; max cont. serv. temp, 200 F; flexibility, high; opaque. For washers, gaskets, stampings for electrical parts, etc.

Vulcanized fiber; paper base material, furnished in sheet and rods or tubes, for machining or stamping into parts. Abrasion resistance, low; resists corrosion caused by oils and greases; flexibility, low, and high when treated with glycerine; ts, 6500-3500 psi; comp str, 20-35,000 psi; nonflammable; available in red, gray, white and black olive; shatterproof; sp gr, 1.36-1.4; corrosion-resistant. For insulation, special gaskets, washers, special parts, dust-guards, pulleys and gears, etc.

PENNVERNON (Double-strength window glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Generally chemical resistant; nonflammable; flexibility, low; ts, 65,000 psi; moisture absorption, low; sp gr at 70 F, 2.52; transparent. For use where unusual strength is required.

PERBUNAN (Nitrile synthetic rubber)—Enjay Co. Inc., New York 19.

Furnished in sheet; abrasion resistance, high; is especially resistant to petroleum hydrocarbons, fats, oils and alcohols; max cont serv temp, 300 F; flexibility, high; dielectric strength (volts per mil. inst.), 380; ts, 100-4000 psi; elong, 100-800%; compression set, 3.5% min.; moisture absorption, low; produced in any color desired; is shatterproof; sp gr, 0.97; is opaque; hardness, 10-100 Shore Durometer A. Used for revolving shafts and bearing seals, flexible hose, vibration damping units, rolls, casters, flexible couplings, packings, gaskets, boots, mountings, diaphragms, milking machine inflations, etc.

PERDURO (Malleable iron castings)—Jeffrey Mfg. Co., The, First Ave. and Big Four Railroad, Columbus 16, O.

C 1.60-1.90, combined C 0.40-0.60, Mn 0.50-0.70, Si 0.90-1.10. Heat treated; ts, 80-90,000 psi; ys, 60-70,000 psi; elong in 2 in., 8-6%; Bhn, 179-207. For chain links, sprockets, etc.

PERMANITE (Furane resin thermosetting plastics)—Maurice A. Knight Co., Akron 9, O.

Furane resin; thermosetting; furnished in sheet or laminated form, for compression molding and casting. Abrasion resistance, medium; resistance to acid and alkalies, excellent; max cont serv temp, 350 F; ts, 1000 psi; comp str, 50,000 psi; available in black only; moisture absorption, low; sp gr, 90 lb per cu ft; opaque. Used as acid and alkali-proof cement and for structural parts exposed to acids and alkalies. Can also be cast into various shapes in rubber molds, cellulose acetate molds and steel molds.

PERMITE (Aluminum-base alloy castings)—Aluminum Industries Inc., Cincinnati.

Following grades are available as sand castings, permanent-mold castings, and high pressure die castings.

No. 1002; Cu 10, Fe 1.5, Mg 0.4, balance Al. For pistons for automotive, pump and refrigeration service.

No. 1010; Cu 4, Si 1, balance Al. For machine parts to resist shock. Heat treatment is to soak at critical and quench in water, and reheat at 350 F to desired properties.

No. 1019; furnished in ingots and sand castings and permanent-mold castings. Si 5, Cu 1.25, Mg 0.5, balance Al; heat treatment, quenching in water. Suitable for highly-stressed parts including airplane engine parts.

No. 2011; Si 5; balance Al. For parts subject to atmospheric corrosion.

No. 2021; Mg 4, balance Al. For parts subject to salt water corrosion.

PERMOLD (Aluminum castings)—The Permold Co., Medina, O.

Sand-cast and permanent-mold aluminum castings of standard analyses to specification.

PETERSON (Steel)—Peterson Steels Inc., New York 17.

An SAE 52100 steel in following analysis: C 0.95-1.10, Mn 0.25-0.45, Si 0.20-0.35, P 0.25 max, S 0.25 max, Cr 1.30-1.60, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max; furnished in rough bars or billets, finished rods, forgings, bars and tubing; abrasion resistance, high. For ball and roller bearings, spindles, thrust collars, hardened sleeves, clutch liners and faces, etc.

PHEMALOID (Plywood)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Compound lumber; phenolic resin bonded; furnished in sheets; waterproof; resistant to fungus, bacterial decay, and diverse climatic conditions; bendable to desired forms. Used for truck, bus and train floors, boat hulls and decks, etc. Supplied in flat stock only, in sizes 48 x 96 in. and 72 x 96 in.

PHENOLITE (Laminated plastics)—National Vulcanized Fibre Co., Wilmington, Del.

Furnished with base of paper, asbestos paper, cotton, asbestos and glass cloths in sheets, rods, tubes and fabricated shapes; also laminated with rubber sheet; high dielectric and mechanical strengths; low moisture absorption; heat-resistant; nonfusible; resistant to acids, solvents and oils; high resistance to wear and impact; machinable. Used in electrical, mechanical and chemical applications for silent gears, bearings, bushings, washers, valve disks and terminal strips, etc.

PHILO (Ferro alloys)—Ohio Ferro Alloys Corp., Canton, Ohio.

Ferro alloys for deoxidizing agents and for alloying in the production of iron and steel.

PHOS-COPPER (Brazing alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

Manufactured in rod and strip form, containing 5-7 per cent phosphorus and balance copper; highly corrosion-resistant; gives strong joints when used for brazing copper and copper alloys to each other.

PHOSNIC (Bronze)—Chase Brass & Copper Co., Waterbury 91, Conn.

Cu 98.15, Ni 1.10, P 0.25. Furnished in wire. Heat treated; ts, 120,000 psi; ys, 105,000 psi; elong in 2 in., 3%; hardness, Rockwell B, 95; nonmagnetic; resists industrial atmospheres, sea air and water, many saline solutions and dilute acids. For bolts, screws, rivets, springs, etc.

PICCOLASTIC (Polystyrene thermoplastic plastics)—Harwick Standard Chemical Co., Akron, O.

Furnished in solid form for casting and hot melting, in clear colors. Sp gr, 1.02; transparent.

PINCO (Porcelain) — The Porcelain Insulator Corp., Lima, N. Y.

Ceramic base material; furnished in rods or tubes and special shapes, for molding and extruding; abrasion resistance, high; resists corrosion caused by contamination in air, oil pyronol, or most acids; flexibility, low; dielectric strength, 250 kv.—⅜-in. thickness and 170 kv.—1-in. thickness; ts, 5000-8000 psi; compressive, 100,000; moisture absorption, 0 after 10,000 psi pressure for 24 hrs. Produced in color; sp gr, 2.4; opaque. For pumps (acid) pipe-insulating bases, valves (acid), etc.

PIONEER (Nickel-chrome alloy steel) — Pioneer Alloy Products Co., Cleveland 12.

Furnished as sand castings to specifications; no heat treatment required; ts, 74,000 psi; ys, 36,500 psi; elong in 2 in., 42%; sp gr, 7.833; nonmagnetic; resists corrosion caused by sulphuric, nitric, phosphoric and other acids; abrasion resistance, high.

PITALOY (Manganese-molybdenum steel)—Pittsburgh Steel Foundry Co., Glassport, Pa.

Manganese-molybdenum alloy: Ts, 85,000 psi; ys, 55,000 psi; elong, 22%; reduction of area, 40%; machinability, good. Used for locomotive frames, crossheads, coupling boxes and spindles, driving wheel centers, gears, etc.

PITTSBURGH (Plate glass) — Pittsburgh Plate Glass Co., Pittsburgh 19.

Plate glass generally chemical resistant; nonflammable; low flexibility; ts, 6500 psi; comp str 36,000 psi; moisture absorption, low; available in water white, blue, flesh-tinted, blue-green; sp gr at 70 F, 2.52. For food processing equipment, etc.

PITTSBURGH (Steels) — Pittsburgh Steel Co., Pittsburgh 30.

Carbon and alloy steels, carbon and alloy wire and rods, and carbon, alloy and stainless seamless tubes to standard specifications such as AISI and SAE Analyses.

PLASKON (Thermosetting plastics)—Plaskon Division, Libbey-Owens-Ford Glass Co., Toledo.

Urea-formaldehyde, thermosetting material; furnished in powder and granules for compression and transfer molding; abrasion resistance, high; resists corrosion caused by weak acids and alkalies; heat resistant to 170 F; flexural str, 10-16,000 psi (ASTM D 650-42T); dielectric str, 300-400 volts per mil; ts, 8000-13,000 psi; comp str, 25-35,000; impact str, 0.24-0.35 ft lb (Izod); moisture absorption, medium; available in colors; sp gr, 1.50±0.02; translucent. Used for housings, trim, knobs, dials, etc.

Melamine-formaldehyde, thermosetting material; furnished in powder and granules for compression and transfer molding; abrasion resistance, high; resists corrosion caused by weak acids and alkalies; heat resistant to 210 F; dielectric str, 300-400 volts per mil; ts, 8000-13,000 psi; comp str 25-35,000; available in colors; sp gr, 1.50±0.02; translucent. For handles, dials, gage plates etc.

PLASTACELE (Thermoplastic plastics)—E. I. Du Pont de Nemours & Co., Inc., Arlington, N. J.

Cellulose acetate base, thermoplastic; furnished in powder, sheets, rods and tubes for machining and molding. Swaged and machined articles are affected only slightly by weak acids and alkalies; decomposed by strong acids and alkalies; soluble in acetone, acetates, etc. Max cont. serv. temp, 165-190 F at 66 psi; flexural str, 6-9000 psi (ASTM D 650-42T); dielectric str, 275-350 volts per mil; ts 2800-8000 psi; comp str, 4-7000 psi; impact str, 1.0-4.0 ft-lb (Izod); available in colors; moisture absorption, medium; sp gr, 1.27-1.37; transparent, translucent and opaque. Used for oil gages.

PLASTECH (Methyl-methacrylate thermoplastic)—Technical Plastics Co., Drexel Hill, Pa.

Methyl-methacrylate, thermoplastic; furnished in rods and sheets for blow molding. Chemical resistance, good; max cont serv temp, 150 F. For machine guards.

PLASTIKFLEX (Flexible tubing, thermoplastic)—R. D. Werner Co. Inc., New York.

Flexible tubing, thermoplastic; to be extruded. Used for conduits, insulation, hose, fuel lines, hospital equipment, sleeving, spacers, stirrup pumps, gaskets, gages (square tubing for dehydration), etc.

PLAST-IRON (Powder metal) — Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

99% iron. After pressing in die, material is sintered in protective atmosphere at 1800 to 2200 F for from 30 to 90 minutes. Apparent density of powder, 2.2-2.7 grams per cu cm; weldability, good; abrasion resistance, high. For permanent magnets, iron cores, and other powder metal parts.

PLAST-MANGANESE (Powder metal) — Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

99% manganese. Apparent density, 3.5 grams per cu cm; nonmagnetic. For strong, hard ferrous parts made by powder metallurgy.

PLAST-NICKEL (Powder metal)—Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

99% nickel powder, 6 to 325 mesh; furnished in blended powders and separate unblended powders. For alloying with iron powder and for compacted and sintered nickel powder parts. For electrical contacts and other powder metallurgy parts.

PLAST-SILICON (Powder metal)—Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

Si 97, Fe 1. Powder metal for alloying. Apparent density, 0.9 to 1.3 grams per cu cm; nonmagnetic. For parts made by powder metallurgy requiring special corrosion resistance or electrical properties.

PLAST-SPONGE (Powder metal)—Plastics Metals Div., The National Radiator Co., Johnstown, Pa.

Fe 97, C 0.9, Mn 0.3, P 0.1, Si 0.2. Powder metal. After pressing in die, sinter in protective atmosphere at 1800-2200 F; for from 15 to 90 minutes. Apparent density of powder, 2.2-2.7 grams per cu cm; magnetic; weldability, fair; abrasion resistance, high. For oilless bearings, iron cores, and other parts made by powder metallurgy.

PLAST-STEEL (Powder metal)—Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

Steel powder, 100-325 mesh; in blended powders and separate unblended powders prepared to customers' specifications; for powder metal parts requiring high physical properties such as gears, cams, pawls, etc.

PLATINUM CLAD (Platinum-clad metals)—Baker & Co. Inc., Newark 5, N. J.

Pure platinum welded to various base metals, in sheet, tubing and wire. Resists corrosion caused by usual acids; medium abrasion resistance; good weldability; ts, ductility, etc., are dependent upon properties of base metals. Used for tubing exposed to acids and for vessels subject to same.

PLAX (Polystyrene plastics)—Plax Corp., Hartford, Conn.

Thermoplastic; furnished in rods, sheets, tubes, fibers and blown ware. Ts, 5500-7000 psi; flexural str, 8000-19,000 psi; comp str, 11,500-15,200 psi; Rockwell hardness, M 80-M 95; elong, 1.5-3.5%; softening point, 220-240 F; sp gr, 1.05-1.07; water absorption (24 hours), 0.04-0.06; machinability, fair to good. Tubing is used for high-frequency electrical insulations, chemical applications, etc.

Cellulose acetate; furnished in rods, sheets, tubes and fibers. Ts, 3000-10,000 psi; flexural strength, 1500-12,000 psi; comp str, 5000-30,000 psi; Rockwell hardness, M 25-M 80; elong, 7-80%; softening point, 145-260 F; sp gr, 1.27-1.37; water absorption (24 hours), 2-6%; machinability, good.

Cellulose acetate butyrate; furnished in rods, sheets, tubes and fibers. Ts, 2500-6700 psi; flexural str, 2000-13,000 psi; comp str, 7500-22,000 psi; Rockwell hardness, M 25-M 69; elong, 35-95%; softening point, 140-250 F; sp gr, 1.10-1.24; water absorption (24 hours), 1.6-2.1%; machinability, good. Sheet is used for electrical and telephone insulation; rod is used for knobs, handles, tool handles, etc.

Ethyl cellulose; furnished in rods, sheets, tubes and fibers. Ts, 2000-9000 psi; flexural str, 3000-12,000 psi; comp str, 8000-20,000 psi; Rockwell hardness, M 25-M 65; elong, 5-100%; softening point, 200-260 F; sp gr, 1.07-1.18; water absorption (24 hours), 1.0-2.5%; machinability, good.

Polyethylene; furnished in rods, sheets, tubes and fibers. Ts, 1700-1900 psi; flexural str, 1500-1700 psi; Rockwell hardness, R 25-R 35; elong, 50-600%; softening point, 219-239 F; sp gr. 0.92; water absorption (24 hours), 0.005-0.01%; machinability, fair to good.

Methacrylate; furnished in rods, tubes and fibers. Ts, 4000-7000 psi; flexural str, 10,000-17,000 psi; comp str, 10,000-12,000 psi; Rockwell hardness, M 40-M 70; elong, 1-5%; softening point, 150-230 F; sp gr, 1.16-1.20; water absorption (24 hours), 0.4-0.5%; machinability, good.

PLEXENE (Styrene-base plastics)—Rohm & Haas Co., Philadelphia 5.

Modified styrene copolymer, thermoplastic; furnished in powders for injection molding. Abrasion resistance, medium; chemical resistance, good; max cont serv temp 194 F; flexural str, 16,000 psi (ASTM D 650-42T); dielectric str, 350±25 volts per mil (short time test); ts, 10,000 psi max; comp str, 15,000 psi; impact str, unnotched, 4-5 ft-lb (Charpy); notched, 1.02 ft-lb (Izod); produced in colors, natural color amber; moisture absorption, low; sp gr, 1.08; transparent, translucent and opaque; machinability, good. For pen and pencil barrels, radio cabinets, etc.

PLEXIGLAS (Acrylic-base plastics) — Rohm & Haas Co., Philadelphia 5.

Methyl-methacrylate, thermoplastic; furnished in sheets, granules and powders for injection and compression molding and forming. Abrasion resistance, medium; chemical resistance, good; max cont serv temp, type "I-A" sheet, 140 F; type "II" sheet, 180 F; molding powder, up to 212 F; flexural str, 13,000+ psi, (ASTM D 650-42T); dielectric str, 400 volts per mil (0.125-in. thick material); ts, 6800 psi min; comp str, 13-15,000 psi; impact str, unnotched, 3-4 ft-lb (Charpy); notched 0.35 ft-lb (Izod); produced in colors; moisture absorption, low; sp gr, 1.18; transparent and translucent; machinability, good. For guards, pump parts, dials, housings, etc.

PLEXIMENT (Plastics cement)—Plastic Parts & Sales, St. Louis 10, Mo.

Furnished in liquid form for cementing acrylic resin plastics parts. Furnished clear only.

PLUSWOOD (Resin-impregnated wood) — Pluswood Inc., Oshkosh, Wis.

Resin-impregnated plywood. Furnished in any desired thickness, in large or small sheets, in natural dark deep brown color. Has wood grain with high gloss finish; high density; lightweight; and is resistant to exposure. It can be sawed, drilled, turned, threaded, milled and tapped; nonflammable; highly resistant to decay, acids, alcoholic mixtures and other organic liquids. Sp gr, 1.3-1.4; ts (parallel laminated in fiber direction), 32-40,000 psi; comp str, 20-28,000 psi; impact (Izod), 6-8 ft-lb per in. of notch. For use as exhaust and blower fan blades, and in boat-building, aircraft and automotive industries.

PLYMETL (Sheet-metal bonded plywood)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Resin-bonded plywood, sheet metal bonded to one or both faces; has stiffness, rigidity, light weight; metal on both faces insuring freedom from warpage. Types available for different purposes are galvannealed steel, stainless steel, aluminum, copper, chrome zinc, chrome steel, porcelain, etc. Used for applications in the automotive and railroad fields.

PLYMOLD (Plywood) — Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Resin-bonded plywood, molded in simple or compounded curvatures.

PLYOPHEN (Plastics resins and varnishes) — Reichhold Chemicals Inc., Detroit 20.

Phenolic aldehyde, thermosetting. Furnished as liquid resins or varnishes; soluble in alcohol. For laminating, impregnating, bonding and casting; abrasion resistance, high; resists corrosion caused by nearly all chemicals except strong oxidizing acids and strong alkalies. Heat resistant to 275 F; flexibility, medium; dielectric str, 300-900 depending on the requirement; ts, 10-36,000 psi; comp str, 35,000 psi; moisture absorption, low; available in natural or black; shatterproof. For use where good mechanical properties are needed along with good dielectric strength, and corrosion resistance. One type used for bonding of wood under heat and pressure for plywood. Others are laminating varnishes used with paper, canvas, fiber glass, etc., to produce phenolic laminates, properties of which depend on the type of paper, etc., used. Tensile strength of 26,000 psi can be obtained for paper laminates; while with fiber glass, tensile strengths of 80,000 have been produced.

PLY-TECH (Plywood) — Technical Ply-Woods, Chicago 1.

Thermoplastic; furnished in sheet form for machining. Abrasion resistance, medium; resists corrosion, caused by moisture and termites; flexibility, medium; tensile and compressive strength depend on construction; moisture absorption depends on treatment; shatterproof; machinability, good.

POLAROID (Light-polarizing glass) — Polaroid Corp., Cambridge, Mass.

Principal property is 99.5% polarization of transmitted light uniformly over large area. Used for camera filters, polarizing attachments for microscopes, polarimeters, and other scientific instruments. Also for polariscopes to determine strain.

POLYFLEX (Polystyrene plastics)—Plax Corp., Hartford, Conn.

Thermoplastic; furnished in laminated sheets, for molding and machining into parts; abrasion resistance, medium; resists corrosion caused by acids, alkalies and alcohol; max cont. serv. temp, 170 F; flexibility, medium; dielectric str, 500-3500 volts per mil; ts, 7000-10,000 psi; moisture absorption, low; shatterproof; sp gr, 1,052; transparent; machinability, good. For electronic parts, covers, etc.

POLYTHENE (Thermoplastic plastics)—E. I. Du Pont de Nemours & Co., Inc., Arlington, N. J.

Polyethylene, thermoplastic, supplied in sheets and in powder for molding. Injection or compression molded parts or extruded parts have low abrasion resistance; resist almost all chemical reagents at room temp. Very slowly attacked by concentrated nitric acid; attacked by certain aromatic, aliphatic or halogenated hydrocarbons. Max cont. serv. temp, 85-104 C; flexural str, 1500-1700 psi (ASTM D 650-42T); dielectric str, 460 volts per mil; impact str, 3 ft-lb (Izod); available in colors; moisture absorption, low; sp gr, 0.92; translucent and opaque. For gaskets, packing, dampeners, etc.

POMPTON (Carbon tool steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

High quality carbon tool steel available from warehouse stocks in the general-purpose range C 0.95-1.05. Suitable for arbors, bushings, lathe centers and other machine parts where a water-hardening tool steel is desired.

POWDIRON (Porous iron bearing alloys)—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Porous iron bearing alloys available in three grades. All have high compressive strength.

61-1C; contains no tin and only 10% copper and is impregnated with 25% of oil by volume. Stronger than other materials furnished by company, and recommended for heavy-duty, slower motion requirement where tensile strength is determining factor, as in aviation and ordnance industries. Ts, 30,000 psi; comp str, 140,000 psi.

55P; contains no tin and only 5% copper. Used to conserve copper and tin. Ts, 12,000 psi; sp gr 5.5; comp str, 140,000 psi. Oil by volume, 32%. Subject to corrosion under certain conditions, but due to protective film of oil will show less tendency to corrode than steel shaft.

59-I; straight-iron material impregnated with 25% oil by volume. Recommended for parts other than bearings which may or may not be sized to close dimensions. Smooth mirror finished surface reduces friction. Ts, 12,000 psi; comp str, 130,000 psi.

POWER NICKEL GENUINE (Babbitt) — Magnolia Metal Co., Elizabeth, N. J.

Approximately 85% tin, nickel treated, free of lead; Bhn, 27. Designed to withstand heavy sustained loads and high heat conditions. It is alloyed for strength and hardness, and will not squeeze out under heavy pressures.

PRECISION (Aluminum and zinc-base alloys)—Precision Castings Co. Inc., Syracuse, N. Y.

Type A-12; aluminum base alloy; Si 12, balance Al. Resists heat to 1000 F; ts, 33,000 psi; sp gr 2.66. For general aluminum die casting uses.

Type ZN-5, zinc base alloy; Al 4, Cu 1, Mg 0.04, balance zinc; ts, 42,000 psi; comp str, 85,000; sp gr, 6.71; bhn, 75. For general die casting uses—automotive, washing machines, electrical equipment, etc.

A-50; aluminum base alloy; Si 5, Al bal., furnished as castings. Resists corrosion caused by atmosphere, foods, etc., resists heat to 1000 F; abrasion resistance, medium; ts, 29,000 psi; ductility, medium. For use where corrosion resistance and ductility are needed.

A-54, aluminum base alloy; Si 5, Cu 4, Al bal., furnished as castings. Resists corrosion caused by atmosphere; resists heat to 1000 F; ts, 32,000 psi. General aluminum die cast parts.

A-94; aluminum base alloy. Si 8.5, Cu 3.5, Al bal. Substitute for A-54 alloy wherever possible. Conforms to Federal Specification AXS-679, Rev. 3.

PRECISION (Tubing and wire)—Precision Tube Co., Philadelphia.

Seamless tubing in nickel, aluminum, copper and brass. For machining, cold working, drawing, brazing and plating. Hardnesses to specification. For vacuum tube parts, air restriction tubing, temperature and pressure control apparatus and instrument pointers.

Precision metal shielded wire; copper, brass, aluminum or nickel, tubing around virtually any dielectric and inner conductor. For machining and cold working; weldability, good; max cont. serv. temp. depends on dielectric strength. For electronic equipment, sound systems, shielding conductors in corrosive atmospheres, shielded wires, radio components.

PREG-TECH (Impregnated wood) — Technical Ply-Woods, Chicago 1.

Thermoplastic; furnished in sheet form for machining into parts. Abrasion resistance, low; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; shatterproof; machinability, good.

PRESDWOOD (Wood)—Masonite Corp., Chicago.

Wood fiber board furnished in sheets ⅛, 3/16, ¼, 5/16-inch thick, max size 4 x 12 ft, for machining into parts. Abrasion resistance, medium; chemical resistance, good to fairly weak solutions; max cont. serv. temp, 300 F; flexibility, low; ts, 3200 psi; comp str, 16.500 psi; transverse str, 5900 psi; moisture absorption, low; available in natural brown, opaque, shatterproof; sp gr. 1.02; machinability, good. For various industrial uses. This material is also available in "Tempered" and "S2S Tempered" grades.

PRESSUREDIE No. 2 (High alloy steel)—Braeburn Alloy Steel Corp., Braeburn, Pa.

High alloy steel containing C 0.35, Si 0.90, Cr 5.00, V 0.20, Mo 1.40, and W 1.10. Furnished in rough bars or billets, finished rods or bars, for machining. Recommended heat treatment, 1825 F air cool, draw 1050-1150 F. In heat-treated state: Ts, 250.000 psi; ys, 200,000 psi; Bhn, 417-514. For extrusion dies, extrusion press rams and liners etc.

PROMAL (Malleable iron)—Link-Belt Co., Indianapolis 6.

Specially processed malleable iron having high yield and fatigue strengths; for resistance to mild corrosive attack can be furnished with copper content; can be hot-dip galvanized without embrittlement and can be used in ovens and furnaces up to 1100 F. Uses include conveyor and drive chain links, bearing caps, rocker arms, sheaves, levers and other parts subjected to severe service.

PROMET (Bronze bearing metals)—The American Crucible Products Co., Lorain, O.

Have great compr str, low coefficient of friction, good lubricating qualities. Ts, 18-50,000 psi; ys, 11-26,000 psi; Bhn, 38-75; elong in 2 in., 26.5-12%. For bearings and wearing parts, such as spur and worm gears, bushings, seals, thrust plates, etc.

PSF (Steels)—Pittsburgh Steel Foundry Corp., Glassport, Pa.

Steel castings up to the largest in carbon or alloy steels and Pitaloy. For railroad and marine industries; also for other types of machines.

PSI (Steels)—Peterson Steels Inc., New York 17.

No. 1; C 0.92-1.02, Mn 0.95-1.25, Si 0.50-0.70, P 0.025 max, Cr 0.90-1.15, S 0.025 max, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max; furnished in rough bars or billets, finished rods or bars, forgings, and tubing, for machining. Abrasion resistance and tensile strength, high. For ball and roller bearings, bushings, thrust collars, spindles, hardened sleeves, clutch liners and faces, knives, etc.

No. 2; C 0.87-0.97, Mn 1.40-1.70, Si 0.60-0.80, P 0.025 max, S 0.025 max, Cr 1.40-1.70, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max; furnished in ingots. Rods or bars, forgings and tubing, for machining. Abrasion resistance and tensile strength, high; good bearing qualities. For ball and roller bearings, bushings, spindles, collars, hardened sleeves, clutch liners and faces, etc.

PURE (Carbon) — Pure Carbon Co. Inc., St. Marys, Pa.

Furnished in plates for grinding, corrosion resistant; heat resistant; good machinability; good bearing properties. For seals and wearing rings, pistons, cylinder liners, thrust bearings, and for all types of brushes for electric motors and generators, etc.

PYRALIN (Thermoplastic plastics) — E. I. Du Pont de Nemours & Co., Inc., Arlington, N. J.

Nitrocellulose base, thermoplastic; furnished in sheets, rods and tubes for machining into parts. Swaged, die-pressed and machined parts offer abrasion resistance, are unaffected by weak acids, but decomposed by strong acids; gradually decomposed by alkalies and soluble in alcohols and esters. Max cont. serv. temp, 170-185 F at 66 psi; flexural str, 6000-15,000 psi (ASTM D 650-42T); dielectric str, 250-500 volts per mil; ts, 3-8000 psi; comp str, 20-30.000 psi; impact str, 5-9 ft lb (Izod); available in colors; moisture absorption, low; sp gr, 1.33-1.6; transparent, translucent and opaque; good machinability. Used for handles, gage glasses, instrument covers, etc.

PYRAMID METAL (Antifriction metal)—Magnolia Metal Co., Elizabeth, N. J.

Lead-tin-antimony-arsenic alloy furnished in ingots. Ts, 17,850 psi; ys, 8875 psi; bhn, 25; abrasion resistance, medium. For applications where bearings must withstand heavy sustained pressures such as in marine reciprocating engines, water turbines, paper mill calender stocks, etc.

PYRASTEEL (Alloy steel castings) — Chicago Steel Foundry Co., Chicago.

Ni varies from 8% up, Cr from 08.26 per cent; available as castings for heat-treating furnaces, screw conveyors, or any high-temperature service to 2200 F. Also available in following grades:

No. 14; Cr 6, Mo 5.

No. 18; Ni 25, Cr 16.

No. 20; Ni 35, Cr 18.

No. 2000; Cr 26-28, Ni 12-14.

All of these grades carry a high silicon content, varying from 1-2.5 per cent.

PYREX (Glasses)—Corning Glass Works, Corning, N. Y.

In general, glasses with coefficient of expansion ranging from 20 to 50 x 10^{-7}° C. Blown, drawn, pressed products with wide range of chemical, physical, optical, electrical and mechanical properties.

PYROPLAX (Cold-molding plastics) — Cutler-Hammer Inc., Milwaukee.

Asbestos base; furnished in cold-molded pieces; heat resistant to 800-1000 F; nonflammable; dielectric str, 40 volts per mil; resistant to corrosion and abrasion. Used for machine parts where resistance to high temperature is needed.

PYTHON (Water-hardening steel) — Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.85, V 0.25. For chuck jaws, clutch pins and other parts requiring unusual wear and shock resistance. Water hardening.

R

RANDALL (Bronze)—Randall Graphite Products Corp., Chicago.

SAE No. 64 bronze or as specified; furnished as sand castings. Resists corrosion caused by moisture; resists heat to 700 F; high abrasion resistance; ts, 30,000 psi; medium ductility; good bearing properties; conductivity, good; bhn, untreated, 80. For use as bushings, graphite-inserted in the perforated or drilled hole, grooved, or reservoir type.

RANIER (Ferro alloys)—Ohio Ferro Alloys Corp., Canton, Ohio.

Ferro alloys for deoxidizing agents and for alloying in the production of iron and steel.

RAYDUCT (Butt-welded steel pipes)—Bethlehem Steel Co., Bethlehem, Pa.

High ductility; used for radiant heating.

REANITE (Plastics bonding resin) — United States Stoneware Co., Akron, O.

Resinous base, thermosetting material, furnished in liquid form, for bonding metals to metals or rubber and plastics to metals; abrasion resistance, medium; resists corrosion caused by acids and alkalies; heat-resistant to 300 deg F; flexibility, high; ts, 3000 psi; moisture absorption, low; shatterproof; available in black only; opaque.

REDALOY No. 8 (Forging Brass)—Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 54, Pb 3.4, balance Zn. Forges freely but is slightly more difficult to machine than yellow brass. Color matches closely that of red brass. Used in hardware and plumbing industries.

RED ANCHOR (Drill rods)—Anchor Drawn Steel Co., Latrobe, Pa.

C 0.95-1.1; commercial carbon drill rods. Strength varies from 70,000 psi, annealed; to 225,000 psi fully hardened; reduction in area when annealed, as high as 50 per cent. For precision shafts for motors, spindles, anvils, tools, dies, etc.

RED-CUT SUPERIOR (Alloy steel)—Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.50, 0.60 and 0.70, W 18, Cr 4.00, V 1.00, Si 0.25, and Mn 0.25; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods; for machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Impact str, Charpy (unnotched), 30; hardness, rockwell C 67 max; sp gr. 8.67; magnetic; max cont. serv. temp, 1200 F; abrasion resistance, high. For high temperature springs, etc.

RED-X (Aluminum alloys)—The National Smelting Co., Cleveland 5, Ohio.

No. 5; nominal composition; Si 5.5, Cu 1.5, Mg 0.3, Mn 0.3; furnished in ingots, for sand, permanent-mold, die, precision castings and forgings. When variously heat treated properties are: Ts, 29-48.000 psi; ys, 18-20,000 psi; elong, 1-7%; Bhn, 70-105. Endurance limit 10,000 psi at 100 million; sp gr, 2.70; nonmagnetic; weldability, good; heat resistant to 300 F. Machinability, good. Used for aircraft castings such as superchargers, pump housings, carburetors, engine and motor castings such as cylinder heads, blocks, crankcases, housings, etc., and intricate castings requiring pressure tightness.

No. 8; nominal composition; Si 8.0, Cu 1.5, Mg 0.3, Mn 0.3; furnished in ingots for sand, permanent-mold, die, precision castings and forgings. Various heat treated properties are: ts, 28-49,000 psi; ys, 18-42,000 psi; elong, 1-6%; Bhn, 70-105; sp gr, 2.70; nonmagnetic; weldability, good; heat resistant to 350 F. Many variations of properties obtainable by application of different heat treatments. Has good casting and machining characteristics. Used for aircraft castings, such as superchargers, pump housings, carburetors, engine and motor castings, such as cylinder heads, blocks, crankcases, housings, and intricate castings requiring pressure tightness.

No. 10; nominal composition; Si 10, Cu 1.5, Mg 0.5, Mn 0.5; furnished in ingots for sand, permanent mold, die castings, forgings. Typical properties, heat treated; permanent mold, ts, 40,000 psi; ys, 30,000 psi; elong, 1.0; Bhn, 95; sp gr, 2.69; nonmagnetic; heat resistant to 400 F. For diesel, automotive, and small engine pistons and similar bearing parts because of its high strength and low coefficient of thermal expansion, and good abrasion resistance.

No. 13; nominal composition; Si 13, Cu 1.5, Mg 0.5, Mn 0.5; furnished in ingots for permanent mold and die castings. Typical properties, heat treated, permanent molds, ts, 40,000 psi; ys, 30,000 psi; Bhn, 95; sp gr, 2.69; nonmagnetic; heat resistant to 400 F. Uses same as Red X-10; lower coefficient of thermal expansion and better abrasion resistance.

REFRASIL (High-temperature insulating material)—The H. I. Thompson Co., Los Angeles 7, Calif.

High-silicon-content all mineral insulation; withstands 2000 F indefinitely; is chemically stable; available in batts, cloth, tapes, sleeving, cordage, loose fiber, and in prefabricated blankets. For insulation of high temperature power equipment, hot gas duct insulation, filtration of gases at high temperatures, covering of high-temperature thermocouple lead wires, protection of electrical wire and equipment against heat, flame, and grounding; acoustical insulation at high temperatures; insulation of electric muffle furnaces.

REPUBLIC Double Strength (Alloy steel)—Republic Steel Corp., Cleveland 1.

Low-carbon, Ni-Cu-Mo steel furnished in finished rods or bars, straight and coiled strip, tubing, sheet and plate; for machining, hot and cold working, stamping, drawing, and arc welding. In cold-worked state, ts, 70,000 psi. min; ys, 50,000 psi, min; elong in 2 in., 22 per cent, min; magnetic; resists corrosion caused by atmosphere; abrasion resistance, medium.

RESILON (Thermoplastic plastics)—United States Stoneware Co., Akron, O.

Resinous thermoplastics; furnished in sheets and lumps to be molded and cast into machine parts; corrosion-resistant; flexible; high dielectric strength. Used for lining parts to resist corrosive attack.

RESIMENE (Melamine molding plastics)—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

Combines excellent arc-resistant characteristics of melamine compounds with ready moldability of phenolic general-purpose materials.

RESINOX (Phenolic molding plastics)—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

In standard and special formulas; thermosetting; heat-resistant; sp gr, 1.25-1.75; flexural str, 8000-15,000 psi; ts, 4200-8000 psi; impact str, 0.2-8.00 psi Izod test; water absorption, 0.01-0.6 (immersion 48 hours %). Used in electrical equipment, large housings, radio cabinets, etc. This tradename also refers to phenolic impregnating and treating resins.

RESIN X (Bonding and casting compound)—Furane Plastics & Chemicals Corp., Los Angeles.

Liquid furfural resin, adhesive and casting compound, for casting and bonding. Abrasion resistance, medium; resists corrosion caused by acids and solvents; heat resistant to 250 F; flexibility, low; dielectric str, 500 volts per mil; ts, 4000 psi; comp str, 12,000 psi; moisture absorption, low; produced in dark colors; sp gr, 1.27; opaque; machinability, good. For bonding of nonmetallic materials, etc.

RESISTAC (Aluminum bronzes) — American Manganese Bronze Co., Philadelphia 36, Pa.

Three grades of aluminum bronze; available in sand castings, rods or bars and hammered forgings; strong; light. Resist certain acids and chemicals; retain strength at high temperatures; have excellent fatigue values. Compositions and physical characteristics for all grades are given below:

Nos. 1 and 2; Cu 85-90, Al 8-11, Fe 4 max; ts, untreated, 65-80,000 psi; ys, 28-35,000 psi; elong in 2 in., 20-30 per cent; impact resistance, medium; bhn, 120-150; nonmagnetic; weldability, fair; resists heat to 500 F; abrasion resistance, medium. Used for parts requiring high corrosion resistance, strength, and heat resistance, such as mill and valve guides; and for parts requiring good fatigue resistance.

No. 3; Cu 80 min, Al 8-10, Fe 5 max, Ni 5 max. Can be heat-treated by quenching from 1,600 F, drawn at 700-1000 F, increasing strength and hardness but lowering ductility. In untreated state: Ts, 90,000 psi min; ys, 42,000 psi; elong in 2 in., 15 per cent; impact resistance, medium; bhn, 185 min; practically nonmagnetic; weldability, fair. Heat resistant to 500 F; abrasion resistance, low. For parts requiring high corrosion resistance and strength, such as gears, guides, etc.

RESISTAL (High-strength plastics) — Chemical Research Corp., Tulsa 1, Okla.

High-strength plastics having half the weight of aluminum, good electrical properties. Unaffected by all petroleum solvents, brines and acids and alkalies. Furnished in sheets 1/64 to 2 in. in thickness, in sizes 46 x 46 in., and 30 x 72 in.

RESISTALOY (Forging bronze) — Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 59, Al 2.00, Ni 1.00, Si 0.50, Fe 0.25, balance Zn. In cold-drawn state: Ts, 109,750 psi; ys, 85,000 psi; elong in 2 in., 14.5 per cent; hardness, rockwell B, 92-94. Exceptionally resistant to corrosion by sea water. For shafts, special bearings, forgings, bolts, nuts, studs, etc., on marine equipment.

RESISTOFELT (Laminated felt and Neoprene)—Western Felt Works, Chicago.

Used on revolving shafts; the felt lubricates the shaft and prevents entrance of dust; the Neoprene prevents passage of oil.

RESISTOFLEX (Plastics) — Resistoflex Corp., Belleville, N. J.

Synthetic resin base, furnished in sheet and laminated form, and in rods or tubes; abrasion resistance, high; resists corrosion caused by oils, gasoline, and organic solvents; heat resistant to 250 F; flexibility, high; dielectric str, 10.7 volts per mil; ts, 5236 psi; moisture absorption, medium; sp gr, 1.259. For diaphragms, gaskets, oil, hydraulic, fuel and lubricating hose assemblies and molded parts.

RESISTRESS (Alloy steel castings)—Reliance Steel Casting Co., Pittsburgh, Pa.

Manganese-nickel-vanadium steel castings to specifications. Double normalized and tempered; ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 25%; Bhn, 180. For machine parts subject to high stress and impact.

RESNPREST (Plywood) — Plylock Corp., subsidiary of M & M Wood Working Co., Portland, Ore.

Phenol-formaldehyde bonded plywood; thermosetting; strong by unit weight; panel ¼-in. thick and 12-in. sq. weighs approximately 12 oz and supports over 400 lb; widths to 72 in. (sanded) or 96 in. (unsanded); lengths to 144 in.; special scarfed panels to 50 ft. Thicknesses up to 9 in. made on high frequency thermal press for gusset plates, etc. Cross-ply construction of material makes it splitproof and nails and screws can be fastened to very edge with safety. Resists heat and cold; and has low moisture absorption. Used wherever rigidity and lightweight is needed. Guaranteed against ply separation.

RESPROID (Thermoplastic plastics)—Respro Inc., Cranston 10, R. I.

Furnished in sheets, rods or tubes.

REVALON (Cu-Al-Zn alloy)—Revere Copper & Brass Inc., New York 17.

Cu 76, Al 2.0, As 0.05, balance Zn; in tubing. Resists corrosion caused by high velocity, salt or brackish waters. Abrasion resistance, medium; ts, 85,000 psi (hard); ductility, high; sp gr, 8.33. Used for condenser tubes for utility, oil refinery, marine, heat exchangers, etc.

REVERE (Free-cutting brass)—Revere Copper & Brass Inc., New York 17.

Cu 61.5, Zn 35.5, and Pb 3; furnished in finished rods or bars, straight and coiled strip, for machining into parts. In cold-worked state; ts, 30,000 psi; ys, 45,000 psi; elong in 2 in., 25%; hardness, 78 Rockwell B; sp gr, 8.50. For rods, deep drilling, turning, free-cutting for screw machine parts.

REVERE (Magnesium and aluminum alloys)—Revere Copper & Brass Inc., New York 17.

Magnesium; various alloys in sheets, strips, plates, rods, bars, forging stock, angles, channels, extruded shapes, seamless tubes and forgings.

Aluminum; various alloys in rods, bars, forging stock, angles, channels, extruded shapes, seamless tubes and forgings.

REVOLITE (Resin-impregnated asbestos cloth)—Atlas Powder Co., Zapon Div., Stamford, Conn., and N. Chicago, Ill.

Asbestos cloth base impregnated with Bakelite resin. Used for laundry roll covers for flat work ironing and for press covers.

REX Z METAL (Corrosion-resistant castings)—Chain Belt Co., Milwaukee 4.

Furnished as castings; resists corrosion caused by weather and inorganic acids to a degree; resists heat to 800 F; high abrasion resistance; ts, 80,000 psi; medium ductility; sp gr, 7.45; good bearing properties; Bhn, untreated, 200. For cast parts requiring high strength and good machinability.

REYNOLDS (Wrought aluminum alloys)—Reynolds Metals Co. Inc., Louisville 1, Ky.

2S; available in flat and coiled sheet, plate, flattened wire, drawn wire, rolled rod, bar and rivets.

3S; available in flat and coiled sheet, plate, flattened wire, drawn wire, rolled rod and bar, extruded rod, bar and shapes, tubing, pipe and rivets.

14S; available in extruded rod, bar and shapes, rolled structural shapes and forging stock.

17S; available in flattened wire, drawn wire, rolled rod and bar, screw machine stock, structural shapes.

18S; available in forging stock.

24S; available in flat and coiled sheet, plate, flattened wire, drawn wire, rolled rod and bar, extruded bar, rod and shapes, tubing and pipe and rivets.

Pure clad 24S; available in flat and coiled sheet, plate.

25S; available in forging stock.

32S; available in forging stock.

A51S; available in forging stock.

52S; available in flat and coiled sheet, plate, flattened wire, drawn wire, rolled rod and bar, tubing and pipe.

63S; available in extruded rod, bar and shapes and extruded tubing and pipe.

Hard Clad R301; available in flat and coiled sheet, plate.

R317; available in drawn wire, rolled rod and bar, screw machine stock.

R361; available in flat and coiled sheets, plate, flattened wire, drawn wire, rolled rod and bar, extruded rod, bar and shapes, rolled structural shapes, forging stock, tubing and pipe, rivets.

REZISTAL (Stainless steels)—Crucible Steel Co. of America, New York.

Stainless steels in standard forms to AISI Specifications. For data on types, properties and characteristics see "Stainless Steels" listing at end of this section.

RIGIDIZED Metal (Sheet or strip)—Rigid-Tex Corp. Buffalo 3, N. Y.

Ferrous or nonferrous in sheet or strip, solid or perforated, up to 36 in., in width; any length.

RIVERSIDE (Nonferrous alloys)—Riverside Metal Co., Riverside, N. J.

Phosphor bronze, nickel silver and beryllium copper in sheet, strip, wire and rod form.

ROCKRITE (Seamless tubing)—Tube Reducing Corp., Wallington, N. J.

In SAE-52100 steel analysis; furnished in seamless tubing (cold reduced), for machining into outer and inner raceways of ball bearings. Hardness as furnished, Rockwell C, 27-31, depending upon size and gage. For bearing raceways, sleeves, cylindrical tool parts, or any parts which are to be subjected to wear or abrasion. When quenched in oil, at 1540 F, resulting hardness is the equivalent of Rockwell C 65, which hardness can be lowered according to tempering temperature.

Also in plain carbon steel, such as SAE X-1020; ts, 110,000 psi; ys, 90,000 psi; elong in 2 in., 10 to 12%.

ROL-MAN (Alloy forging steel) — Manganese Steel Forge Co., Philadelphia.

Furnished in rods or bars, wire, sheets and plates, also hot forgings, stampings, wire cloth, welded and ground parts. Contains Mn 11-14; C 1.1-1.4. Resists heat to 400 F; has high abrasion resistance; ts, 140-160,000 psi; comp str, 100,000 psi; high ductility; nonmagnetic; Bhn, heat-treated, 190-210; work-hardened, 325-500. Used where abrasion resistance and high strength are needed.

ROMAN BRONZE (High copper-zinc alloy)—Revere Copper & Brass Inc., New York 17.

Cu 60, Zn 39.25, Sn 0.75; furnished in finished rods or bars and plate, for machining, hot and cold working, and arc, gas and resistance welding. In cold-worked state (rod): Ts, 82,000 psi; ys, 55,000 psi; elong in 2 in., 20%; endurance limit (completely reversed bending), 27,000 psi; sp gr, 8.41; max cont serv temp, 400 F; abrasion resistance, high; resists corrosion caused by salt water. For propeller and pump shafts, piston rods, marine uses, tube sheets, etc.

ROSITE (Inorganic plastics) — Rostone Corp., Lafayette, Ind.

Compression custom molded calcium-aluminosilicate plastics. Resistant to alkalies; max cont serv temp, 900 F; dielectric strength (volts per mil. inst.), 80; ts, 100,000 psi; comp str, 12-15,000 psi; available in a variety of pastel shades; moisture absorption, low; sp gr, 1.6; is opaque; machinability, fair. Dimensionally stable, accurately molded, non-carburizing. For electrical insulators, particularly where heat and arc resistance are needed.

ROSS-MEEHAN (Manganese cast steels)—Ross-Meehan Foundries, Chattanooga, Tenn.

Medium-manganese cast steel; C 0.40-0.50, Mn 1.40-1.60, furnished as sand castings. Heat treated to requirements. In untreated state: Ts, 90,000 psi; ys, 55,000 psi; elong in 2 in., 22 per cent; impact str, 15 ft-lb (Charpy); bhn, 220; max cont. serv. temp, 750 F; Abrasion resistance, high. For sprockets, clutches, rollers, worms or other parts requiring wear resistance and strength where shock loading is not too high.

Manganese-molybdenum cast steel; C 0.30-0.40, Mn 1.40-1.60, and Mo 0.30-0.40; furnished as sand castings; heat treated to requirements. In untreated state: Ts, 90-100,000 psi; ys, 55-65,000 psi; elong. in 2 in., 22 per cent; impact str, 25 ft-lb (Charpy); bhn, 220; weldability, good; max cont. serv. temp, 750 F; abrasion resistance, medium. For machine parts such as frames, yokes, couplings, fittings, etc., where strength and impact resistance are required.

Manganese-vanadium cast steel; C 0.22-0.27, Mn 1.60-1.80, and V 0.10-0.15, furnished as sand castings, heat treated to requirements. In untreated state: Ts, 90,000 psi; ys, 55,000 psi; elong in 2 in., 25 per cent; impact str, 50 ft-lb (Charpy); bhn, 207; weldability, fair; abrasion resistance, low. For parts requiring good strength and good resistance to impact loading.

ROTARY (Steels)—Rotary Electric Steel Co., Detroit 20.

All standard SAE grades of alloy steels in standard forms.

RS (Radio spaghetti)—Irvington Varnish & Insulator Co., Irvington, N. J.

Braided cotton sleeving coated with a smooth, continuous, lacquer film; conforms to ASTM and VTA specifications for Grade B-2 flexible varnished tubing; highly resistant to aging; obtainable in five colors.

RUBEROID (Insulating tape) — Ruberoid Co., New York 18.

Electrical insulating tape. Abrasion and chemical resistance, high; max cont. serv. temp, 212 F; flexibility, high; high dielectric, tensile, transverse and flexural strengths; available in black, opaque; shatterproof.

RUBEROK (Rubber)—The Richardson Co., Melrose Park, Ill.

Special rubber furnished in sheet form; high dielectric strength; low moisture absorption, low loss factor. Used for electrical insulation. Also hard rubber molded into parts, particularly desirable for electrical, heat and cold insulation; for industrial uses.

RURALDUCTOR (Stranded steel conductor)—Bethlehem Steel Co., Bethlehem, Pa.

For rural power lines.

RYERSON (Steels)—Joseph T. Ryerson & Son Inc., Chicago 80.

Stocks of carbon, alloy and stainless steels in all standard forms. Complete hardenability data furnished with annealed and as-rolled alloys. (For property and application data on stainless steels see "Stainless Steels" listing at end of this section).

RYERTEX (Laminated plastics)—Joseph T. Ryerson & Son Inc., Chicago 80.

Phenolic type laminated plastics, furnished in sheets, strips, plates, rods or tubes, for molding and machining. Abrasion resistance, high; chemical resistance, high; max cont. serv. temp, 275 F; slow burning; flexibility, medium; ts, 11,000 psi; comp str, 40,000 psi; flexural str, 21,000 psi; moisture absorption, low; available in natural color; shatterproof; machinability, good. For heavy and light-duty bearings either water or oil lubricated. Also for abrasion and or chemical resistance applications.

S

SABECO (Bearing bronzes)—Saginaw Bearing Co., Saginaw, Mich.

No. 5 bearing bronze; Cu 69-71, Sn 4.5-5.5. Pb 24-26 max, impurities 0.2. For light or medium-load and water-lubricated bearings.

No. 9; Cu 69.71, Sn 8.5-9.5. Pb 20-22 max, impurities 0.2. For heavy loads such as average machine tool requirements.

No. 11; Cu 69-71, Sn 10.5-11.5, Pb 18-20 max, impurities 0.2. For worm wheels, clutch shifter shoes, forging machine slides, and extreme heavy bearing conditions.

No. 16; Cu 69-71, Sn 15-16.5, Pb 13.5-14.5 max, impurities 0.2 For friction rings, and heavy-duty boring spindle bearings.

SAFETEE Sealed Brilliance (Mirrors)—Safetee Glass Co., Philadelphia 44, Pa.

Laminated shatter-resistant glass mirrors to specification.

SAFLEX (Thermoplastic plastics sheet)—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

Polyvinyl acetal thermoplastic sheet material, used as an interlayer in laminated safety glass; extremely tough from temperatures below zero to over 120 F.

SANDEE (Thermoplastic plastics)—Sandee Mfg. Co., Chicago.

K-4; vinyl base; heat resistant to 150 F; flexibility, high; ts, at 25 C, 1500 psi; moisture absorption low; available in color; sp gr, 1.22. In rods and tubes for electrical insulation and for replacing rubber tubing and gaskets.

T-2; cellulose acetate butyrate; in rods. or tubes and custom shapes and sections; heat-resistant to 140 F; flexibility, low; dielectric str, 250-400 volts per mil; ts 2300-6700 psi; moisture absorption, low; available in color; shatterproof; sp gr, 1.15-1.24. For manometer tubes, refrigerator moldings, truck body moldings, etc.

SANDUSKY (Cast nonferrous alloys)—Sandusky Foundry & Machine Co., Sandusky, O.

Centrifugally cast bronze, brass and Monel sleeves, liners, tubes, bushings and roll covers from 3 to 46 in. diam. in lengths up to 347 in. depending upon diameters and metal composition. Rings are available from 3 to 72 in. diam. Improved physical properties and machinability resulting from the Sandusky process.

Also bearing metals, copper-base metals and nickel base metals.

SARAN (Polyvinylidene chloride plastics)—The Dow Chemical Co., Midland, Mich., and licensees.

Crystalline, thermoplastic, aliphatic chloride with polymeric base; furnished in special extruded and molded forms; material is corrosion-resistant; very tough and flexible; ts, to 50,000 psi (extruded); low moisture absorption; abrasion-resistant; takes high polish; high dielectric strength; shatterproof; non-inflammable; available in color; transparent to opaque. Used for moldings, gaskets, packings, tubing, belting, fabrics from extruded monofilaments; etc. Licensees: Acadia Synthetic Products Div., Western Felt Works, Chicago; American Hard Rubber Co., New York; Elmer E. Mills Co., Chicago; Firestone Industrial Prods., Akron, O.; National Plastic Products Co., Odenton, Md., Parker Appliance Co., Cleveland; St. Louis Plastic Molding, St. Louis; Celluplastic Corp., Newark 5, N. J.; Deering-Milliken Research Trust, Greenwich, Conn.; Firestone Tire & Rubber, Ltd., Hamilton, Ontario; Goodyear Tire & Rubber Co., Akron, O.; Haveg Corp., Newark, Del.; Commercial Plastics Co., Chicago, Ill.; The Visking Corp., Chicago, Ill.; American Extruded Products Co., Los Angeles, Calif.; Lus-Trus Extruded Plastics, Inc., Ann Arbor, Mich.; The Pantasote Leather Co., Passaic, N. J.

SATCO (Lead-base bearing alloy)—Magnus Metal Corp., Chicago.

Contains from 94-98 per cent lead, with balance tin, calcium and other auxiliary hardeners; melting point about 125 degrees higher than that of tin-base and lead-base babbitt metals, with higher resistance to deformation and wiping at elevated temperature. Material is furnished in ingot form and also lined bearings. Mechanical properties in untreated state; ts, 11-13,000 psi; comp str, 15-17,000; elongation, 8-12 per cent; bhn, 22-24. Recommended as a lining for brass, bronze and steel back bearings. May be used as a substitute for lead and tin base babbitts, block tin and other bearing metals.

S. C. P. (Carbon)—Superior Carbon Products, Inc., 9115 George Avenue, Cleveland, Ohio.

Furnished in rods and plates; max cont serv temp, below 1200 F; transverse strength 2000-4000 psi; moisture absorption, low; furnished in black only; hardness, 10-100 Scleroscope. For seal rings, bearings, molds, pump vanes, valve seats, electrodes, carbon brushes, etc.

SEALMET (Special alloy steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Typical analysis—Cr 27, balance Fe. Alloys having same coefficient of expansion as certain grades of glass. For application where metal wires or strip must be attached directly to glass.

SEALON (Liquid copolymer)—Maurice A. Knight Co., Akron 9, O.

Heavy viscosity liquid; for dipping, spraying, brushing then curing at 350 F in oven heat for 20 to 30 min per coat. Abrasion resistance, good; chemical resistance, very good; max cont serv temp, between 200 and 250 F; available in green, black and white; moisture absorption, quite low; opaque. For agitators, fans, handles and for bonding to steel, copper, brass and aluminum.

SELFLUBE (Bearing alloys)—Keystone Carbon Co., Saint Marys, Pa.

Self-lubricating porous bronze and porous iron, bearings and sleeves; yield point for bronze, 12,090 psi; 50,000 psi max for iron;

ductility, high. For bearings, bushings, etc. Also bronze, brass and iron for structural parts.

SEMINOLE HARD (Oil-hardening steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.50, Si 0.80, Cr 1.30, W 2.25, V 0.25, For high creep strength bolts and studs for superheated steam; for various machine parts subject to repeated shock and wear. Withstands moderately elevated temperatures—intermittent up to about 900 F. Should be hardened in oil.

SEYMOUR (Nickel silvers)—Seymour Mfg. Co., Seymour, Conn.

Alloy No. 5; Cu 61, Zn 34, Ni 5; furnished in wire form; in spring temper, ts, 135,000 psi; elong in 2 in., 2%; electrical conductivity (IACS), 12%.

Alloy No. 10A1; Cu 67, Zn 23, Ni 10; furnished in sheet form; in spring temper, ts, 109,000 psi; elong in 2 in., 1.5%; Rockwell hardness, B 88; sp gr, 8.64; electrical resistivity (IACS), 11.1; electrical conductivity (IACS), 9%.

Alloy No. 12X1; Cu 61, Zn 26, Ni 12, Pb 1; in spring temper, ts, 90,000 psi; elong in 2 in., 5%; Rockwell hardness, B 87.

Alloy No. 15A; Cu 64, Zn 21, Ni 15; in spring temper, ts, 93,000 psi; elong in 2 in., 5%; Rockwell hardness, B 90; sp gr, 8.70; electrical resistivity (IACS), 15.9; electrical conductivitiy (IACS), 6.3%; furnished in sheet form.

Alloy No. 15B; furnished in sheet form; Cu 58, Zn 27, Ni 15; in spring temper, ts, 100,000 psi; elong in 2 in., 2%; Rockwell hardness, B94; sp gr, 8.62.

Alloy No. 15X1; furnished in rod form; Cu 60, Zn 24, Ni 15, Pb 1; in spring temper, ts, 85,000 psi; elong in 2in., 10%; Rockwell hardness, B 80; electrical resistivity (IACS), 16.7; electrical conductivity (IACS) 6%.

Alloy No. 18A3; furnished in sheet form; Cu 65, Zn 17, Ni 18; in spring temper, ts, 100,000 psi; elong in 2 in., 3%; sp gr, 8.75; electrical resistivity (IACS), 16.7; electrical conductivity (IACS), 6.0%.

Alloy No. 18A4; furnished in sheet and wire form; Cu 55, Zn 27, Ni 18; in spring temper, ts, 110-145,000 psi; elong in 2 in., 2.3%; sp gr, 8.68; electrical resistivity 18.2; electrical conductivity (IACS), 5.5.

Alloy No. 18X1; furnished in rod form; Cu 62, Zn 19, Ni 18, Pb 1. In spring temper, ts, 85,000 psi; elong in 2in., 13%; hardness, Rockwell B 80; electrical resistivity (IACS), 17.6; electrical conductivity (IACS), 5.7%.

Alloy No. 18A7; furnished in sheet, rod and wire; Cu 75, Zn 7, Ni 18; in spring temper, ts, 80-115,000 psi; elong in 2 in., [illegible]-7%; sp gr, 8.83; electrical resistivity (IACS), 16.2; electrical conductivity (IACS), 6.2%.

SEYMOUR (Phosphor bronzes)—Seymour Mfg. Co., Seymour, Conn.

Alloy No. 950; Cu 95, Sn 5; in spring temper, ts, 105,000 psi; elong in 2 in., 1.5%; hardness, Rockwell B 95; sp gr, 8.86; electrical resistivity (IACS), 6.1; electrical conductivity (IACS), 16.5%.

Alloy No. 494; Cu 94, Sn 5, Pb 1; in spring temper, ts, 61,000 psi; hardness, Rockwell B 85; electrical resistivity (IACS), 6; electrical conductivity (IACS), 16.8%.

Alloy No. 928; Cu 92, Sn 8; in spring temper, ts, 112,000 psi; elong in 2 in., 3%; hardness, Rockwell B 98; sp gr, 8.80; electrical resistivity (IACS), 7.8; electrical conductivity (IACS), 12.8%.

Alloy No. 910; Cu 90, Sn 10; in spring temper, ts, 115,000 psi; elong in 2 in., 5%; hardness, Rockwell B 100; sp gr, 8.76; electrical resistivity (IACS), 9.4; electrical conductivity (IACS), 10.6%.

Alloy No. 444; Cu 88, Zn 4, Pb 4; in spring temper (small sizes) ts, 60,000 psi; elong in 2 in., 20%; hardness, Rockwell B 75; sp gr, 8.86; electrical resistivity (IACS), 8.2; electrical conductivity (IACS), 12.2%.

S. G. (Cast carbon steels)—Symington-Gould Corp., Rochester, N. Y.

27; C 0.10, Mn 0.10; normalized, ts, 50,000 psi; ys, 25,000 psi; elong in 2 in., 30 per cent. For electrical applications.

13; C 0.25, Mn 0.50; normalized, ts, 70,000 psi; ys, 30,000 psi; elong in 2 in., 26 per cent. For valves, etc.

25; C 0.25, Mn 0.70; normalized, ts, 70,000 psi; ys. 38,000 psi; elong in 2 in., 24 per cent. For railroad and industrial applications.

18; C 0.45, Mn 0.70; normalized, ts, 85,000 psi; ys. 45,000 psi; elong in 2 in., 16 per cent; bhn, 170. For automotive parts.

9; C 0.26, Mn 0.75; normalized and drawn, ts, 70,000 psi; ys 36,000 psi; elong in 2 in., 22 per cent. For parts subject to steam pressure.

SHAMVA MULLITE[1] (Ceramic refractory)—The Mullite Refractories Co., Sheldon, Conn.

Furnished in grain, cement, bricks and special shapes, Abrasion resistance, high; is chemically neutral; softening temperature, 3250 F; dielectric str, better than mica; available in natural color only; sp gr, varies with type, 2.77-2.30; machinability, poor; hardness, Moh's hardness scale, 6-7, coefficient of thermal expansion, 0.00000366-in. per in. per in. per degree C. Used for feeder parts in glass molding machines.

SHARON (Steels)—Sharon Steel Corp., Sharon, Pa.

All standard carbon, alloy and stainless steels in standard forms. Furnished in straight and coiled strip and sheets for machining, hot and cold working, stamping, drawing, brazing, and arc, gas and resistance welding. For data on properties, characteristics, and applications of stainless steels see "Stainless Steels" listing at end of this section.

SHELL DIE (Alloy steel)—A. Finkl & Sons Co., Chicago.

Cr 4.50-5.00, high Si and Mo; normalized or quenched in oil or in air blast. For shell punches, mandrels and die inserts.

SHEEL-PLI (Laminated plastics) — Shellmar Products Corp., Mount Vernon, O.

Thermosetting polyester base laminated plastics in sheet form; abrasion resistance, medium; max cont serv temp, 250 F; dielectric str (volts per mil, inst.), 200-500; ts, 8-50,000 psi; comp str, 15-50,000 psi; produced in unlimited colors; sp gr, 1.2-1.4; transparent, translucent, and opaque; machinability, good; hardness, rockwell M-90 to M-125. Has high dimensional stability, high impact strength, and high chemical resistance.

SHENANGO-PENN (High strength alloy castings)—Shenanago-Penn Mold Co., Dover, O.

Centrifugal castings in all bronzes, Monel Metal and Meehanite metals—A complete range of red bronze alloys, as well as yellow metals including manganese bronzes and aluminum bronzes. Also special alloys such as aluminum and silicon bronzes, copper, etc. Grades of plain and alloy iron, as well as Ni-Resist are available. Furnished in cast tubular bars or cylinders in sizes from 2-26 in. OD and to 26 ft in length; solid bars in diameters ranging from ½ to 8 in.—in standard 6-ft lengths. For immediate delivery stock of both solid and tubular bars under 6¾ in. OD is maintained. Can be adapted to any application where castings are used. Flanges and unusual shapes of various sizes also available. For bearings, bushings, drums, liners, roll covers, sleeves, washers, rings, etc.

SHIELD-ARC (Welding rod)—Lincoln Electric Co., Cleveland.

Type 85; high tensile welding rod; recommended for fabrications of high tensile steels; Bhn, 190-250.

Type 100; Bhn, 235-300.

Type Lh-70; for welding high carbon, high sulphur steels of poor welding quality.

SHOCKPROOF (Malleable iron)—The Lake City Malleable Co., Cleveland 14.

Malleable iron within ASTM Specifications No. 32510 and 25018. Ts, 52-55,000 psi; ys, 34-36,500; elong in 2 in., 12.5-20%; impact str (Charpy), 16.5 (.074 depth notch); endurance limit, 30,000-31,800 psi; Bhn, 110-145; sp gr, 7.32; resists corrosion caused by atmosphere, moisture or water and smoke; max cont serv temp, 800 F. Resists shock and/or impact which may distort the casting but only under the most severe cases will it fail completely. For use in any machine, automotive transportation equipment, electrical fittings, and other applications which require castings in considerable quantities having a maximum dimension under 40 in. min; practical metal thickness 3/32-in. except in very small castings where sections may be lighter.

SHOOK Alloy 664 (Copper-tin-zinc alloy)—Shook Bronze Corp., Lima, O.

Cu 80-83, Sn 7-9, Pb 7-9, Zn 1-2, P 0.75 and Ni 1 max; furnished in finished rods or bars and as sand castings; for machining. Comp str, 35,000 psi; ys, 22,000 psi; elong in 2 in. 20%. For bushings, bearings, gland nuts, gears, etc.

SICROMO (Alloy steels)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

Type 1; C 0.15 max, Mn 0.5 max, P 0.03 max S .03 max, Si 1-1.4, Cr 0.75-1.25. Mo 0.45-0.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. Material is corrosion resistant to 1050 F; ts, 60,000 psi min; fair weldability; bhn, annealed, 163 max. For use in oil refinery field.

Type 2; similar to above with slightly higher chromium content.

Type 2½; similar to Type 2 with slightly lower silicon content.

Type 3; similar to Type 2½, with slightly higher silicon and chromium content.

Type 5; similar to Type 3, with lower silicon content and higher chromium.

Type 5S; similar to Type 5, differing only in higher silicon content.

Type 7; similar to Type 5S, having lower silicon and higher chromium content.

Type 7M; similar to Type 7, but having an increased molybdenum content.

Type 9; similar to Type 7, having higher chromium content. All above materials are for oil refinery use.

Type 9M; similar to Type 9, but having an increased molybdenum content.

SILASTIC (Rubbers)—Dow Corning Corp., Midland, Mich.

Silicone rubbers furnished in crepe and paste for molding, coating, machining, extruding, laminating and friction calendering. Medium abrasion resistance; good resistance to oil, aqueous, neutral amonical reagents and concentrated sodium hydroxide. Some stocks resistant to strong acids except concentrated sulfuric. Max cont. serv. temp, 300-350 F; nonflammable; flexibility, high; dielectric strength, 500-1100 volts per mil depending on grade; ts, 400-700 psi; low moisture absorption; available in red and white; sp gr. 1.3-2.3 depending on grade; opaque. Has high oxidation resistance. For gaskets, diaphragms, seals, packings, tubing, mountings, wire insulation, and weather resistant rubber parts.

SILENTBLOC (Composite rubber-metal material)—The General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind.

Natural and synthetic rubber combined with metal. Used for mountings, bearings, couplings, motor and machine mounts to control vibration and cushion shock loads; lubrication-less oscillating or torque joint; and bushing to correct misalignment in bearings, hinges and shaft supports.

SIL-FOS (Welding rod)—Handy & Harman, New York 7. Brazing alloy containing Ag 15, Cu 80, P 5; flows at 1300 F; furnished in rods, wire, sheets and strips (coiled). Corrosion-resistant; high ductility; sp gr, 8.45. Used to join nonferrous metals only, particularly copper brass and bronze.

SILFRAM (Hard facing rod)—Stoody Company, Whittier, Calif.

Cast of Cr, Ni, Si, C and Fe. Rockwell C hardness, 37-41; machinable with sintered carbide tools. Has high resistance to corrosion, abrasion and impact; produces excellent bearing surface; used on pump sleeves, etc. For oxy-acetylene and dc electric application.

SILMAN (Alloy steel)—Vanadium Alloys Steel

Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.55, Si 2.10, Mn 0.85, Cr 0.25 V 0.28. Furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rod; for permanent mold casting, precision castings, machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: hardness rockwell C, 62-63 max; magnetic; abrasion resistance, medium. For shanks, chisels dogs, shears, etc.

SILMANAL (Magnet material)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Has high intrinsic coercive force, suitable for use in instruments where service in strong electrical fields is required. Ductile and malleable; can be punched, machined, rolled, or ground. Can be made in rod, strip or wire form.

SILMO (Alloy steel)—The Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

C 0.15 max, Mn 0.5 max, P 0.4 max, S 0.045 max, Si 1.15-1.65, and Mo 0.45-0.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc., into parts. Ts, 55,000 psi, min; resists heat to 1000 F; fair weldability; bhn, annealed, 163 max. For use in refinery field.

SILVER STAR (Spring steel)—Bethlehem Steel Co., Bethlehem, Pa.

High-carbon, high-manganese wire for coil springs.

SINTEEL (Steel and copper-steel powder metals) American Electro Metal Corp., Yonkers, N. Y.

R; Low-carbon steel powder metal parts to design specifications. Can be surface hardened by gas carburizing or cyaniding. Ts, 61,000 psi; ys 50,000 psi; elong in 2 in., 5 per cent; hardness, rockwell B 60; abrasion resistance, medium. For cams, gears, and high strength powder metal parts requiring surface hardness up to rockwell C 55. ,

G; Copper-steel powder metal parts to design specifications.Ts, 50-100,000 psi; ys, 40-80,000 psi; elong in 2 in., 20-5 per cent; hardness, rockwell B 50-100; nonmagnetic; weldability, poor; abrasion resistance, medium. For high-strength precision powder metal parts.

SIRVENE (Synthetic rubber)—Chicago Rawhide Mfg. Co., Chicago.

A series of scientifically compounded elastomers (synthetic rubber), custom-developed to enginees' specifications and molded into mechanical pliable parts. Resistant to abrasion, oil, water, gases, air and temperature extremes. Used for sealing oils and greases, and for packings, gaskets and protective covers under unusual or difficult operating conditions.

SIRVIS (Mechanical leather)—Chicago Rawhide Mfg. Co., Chicago.

Leather, especially selected, tanned and treated for mechanical applications. Made in varying degrees of hardness or flexibility with high tensile strength and resilience. Used for protective boots, washers, gaskets, coupling and valve disks, bumpers, pads and frictions.

SKO-RESIN (Thermosetting plastics)—Skoning Corp., East Providence, R. I.

Phenol formaldehyde base, furnished in sheets, preforms, and powder for compression molding; abrasion resistance, low to high; for structural moldings, housings and other structural parts.

SMAVROC (Alloy steel forgings)—The Medart Co., St. Louis.

For rolls for steel or nonferrous mill bar straighteners.

SOFTWELD (Welding electrode)—Lincoln Electric Co., Cleveland. For arc welding cast iron where a soft machinable weld is desired. Weld metal is high nickel alloy.

SORBO-MAT (Cast iron)—Sumner Iron Works, Everett, Wash.

Furnished in sand castings to suit specifications; in unheat-treated state; ts, 32-57,000 psi; comp str, 155-180,000 psi; ys, 32-45,000 psi; Bhn, 185- 260; sp gr, 7.10-7.45; weldability, good; max cont cont serv temp, 1200 F; abrasion resistance, medium; for machine parts such as bases, columns, etc.

SPAULDING ARMITE (Hard vulcanized fiber)—Spaulding Fiber Co., Inc., Tonawanda, N. Y.

Fish paper in sheets and rolls for stamping or forming into parts; ductile; dielectric str, 200-550 volts per mil; abrasion and corrosion-resistant; ts, 9000-15,000 psi.

SPAULDING FIBRE (Hard vulcanized fiber)—Spaulding Fibre Co., Inc., Tonawanda, N. Y.

Furnished in sheets, rods and tubes for machining, stamping or forming into parts; dielectric str, 150-400 volts per mil; ts, 9000-15,000 psi; available in colors: resistant to shock. Used for mechanical and electrical aplications where toughness, lightweight and machining and forming properties are essential.

SPAULDITE (Phenolic plastics)—Spaulding Fibre Co., Inc., Tonawanda, N. Y.

Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes for machining or stamping into parts; dielectric str, 700 volts per mil; low moisture absorption; high polish, corrosion and heat-resistant (220 F); resistant to shock. Used for electrical insulation and where resistance to moisture and chemicals, appearance and permanence are essential.

SPAULDO (Fiber)—Spaulding Fibre Co., Inc., Tonawanda, N. Y.

Fiber material furnished in sheets and rolls for forming or stamping into parts; tear-resistant; dielectric str, 300 volts per mil; heat resistant to 220 F; high polish; corrosion-resistant; ts, 5000-16,000 psi; resistant to shock. Used for applications where flexibility and toughness in both grain directions are essential.

SPEED CASE (Free-machining steel)—Monarch Steel Co., Indianapolis, and affiliate, W. J. Holliday & Co., Hammond, Ind. Also The Fitzsimons Steel Co., Youngstown 8, O.

A low-carbon, free-machining open hearth steel (X1515) furnished in hot-rolled plate and bars, cold finished bars. Typical analysis: C 0.20, Mn 1.25, S 0.25, P 0.04 max, Si 0.07 max. Ts, 62-72,000 psi. Impact resistance at low temperatures and ductility equal to or better than SAE 1020. Machines readily, 200-250 SFPM (average). Case hardens rapidly with deep, uniform penetration. Has low hysteresis loss. Can be forged, cold-formed or rolled and welded. Widely used for gears, spindles, shafts, etc.

SPEED-TREAT (Free-machining steel)—Monarch Steel Co., Indianapolis, and affiliated company, W. J. Holliday & Co., Hammond, Ind. Also The Fitzsimons Steel Co., Youngstown 8, O.

A medium-carbon, free-machining open-hearth steel (X1545) furnished in hot-rolled plate and bars, and cold-finished bars. Typical analysis: C 0.45, Mn 1.30; P 0.04, max, S 0.25, Si 0.07 max. Ts, 90-100,000 psi. Machines 50 per cent faster than SAE 1045. Impact resistance at low temperatures and ductility equal to or better than SAE 1045. Can be satisfactorily heat-treated. Medium hardness and hardenability similar to that of SAE 1045. Can be forged and welded. Used for gears, cams, shaft pins, welded shovel dippers, etc.

SPEER (Carbon and graphite) — Speer Carbon Co., St. Marys, Pa.

Carbon, electrographite, metal-graphite materials; in finished plates, bars, rods, for further machining. Not attacked except by oxidizing chemicals; starts to oxidize at 500 C; sp gr, 2-2.20; ts, 1000-4000 psi; crushing, 2800-4500 psi. Used for contacts, bearings, molds, dies, seal rings, etc.

S-POLYMER S-50, S-60 (Thermoplastic resin)—Enjay Co. Inc., New York 19.

Modified styrene type thermoplastic resin; furnished in form of granules for injection molding, compression molding, transfer molding, casting and extruding. Abrasion resistance, high; has excellent resistance to acids, alkalis, water. Soluble in hydrocarbons and organic solvents. Max cont serv temp, 130-140 F; dielectric strength (volts per mil. inst.), 500-700; ts, up to 6000 psi; comp str, greater than 16,000 psi; generally produced white, but other colors can be produced by compounding; moisture absorption, low; sp gr, 0.93-0.96; is translucent; machinability, poor; hardness, Rockwell M, 10; very low moisture, vapor and gas permeability; internally plasticized; excellent light stability; good compatibility with waxes and other resins; good metal adhesion. For diaphragms, protective coatings during storage, abrasion protection, rollers, guides, etc.

SPONGEX (Sponge rubber)—The Sponge Rubber Products Co., Shelton, Conn.

Furnished in sheets, strips, rods and tubes, extruded or for molding. Abrasion resistance, low; chemical resistance, excellent against many commercial chemicals and oils; max cont. serv. temp, 175 F; flexibility, high; ts, 25-150 psi; available in black, tan, red and other colors; opaque; shatterproof. For vibration elimination, cushioning, sealing and gasketing.

STACKPOLE (Powder metals)—Stackpole Carbon Co., St. Marys, Pa.

Silver-tungsten; for contacts for circuit breakers, relays, contactors, etc; rockwell B, 85-90; sp gr, 11.4-15; weldability, good.

Silver-molybdenum; furnished in parts finished to size; rockwell B, 80; sp gr, 10.3; weldability, good. For contacts for circuit breakers, relays, contactors, etc.

Iron powders; molded to close tolerances. Used for gears, pole pieces for small motors, magnetic yokes, iron cores, also large parts and unusual shapes where much machining is ordinarily involved.

STAINWELD (Welding electrodes) — Lincoln Electric Co., Cleveland.

Coated electrodes for welding stainless steels or building up surfaces to resist corrosion.

Type A-5; for large number of so-called 18-8 stainless steels. Welds are of high tensile strength and ductility and possess same resistant qualities as the parent metal. Contains suitable amount of columbium to prevent intergranular corrosion of deposited metal.

Type A-7; for stainless steels of 18 per cent chromium, 8 per cent nickel type; fast flowing, smooth operating. Especially adapted for surfacing other steels with minimum admixture of base metal.

Type B; for arc welding stainless steel with chemical content of approximately 25 per cent chromium and 12 per cent nickel. Physical properties equal to metal welded.

Type C; a modification of the well-known 18-8 analysis, commonly known as 18-8 SMO (approx 3½ molybdenum). Suitable for welding stainless steels of Types 316-317.

Type D; for stainless steels of 25 per cent chromium, 20 per cent nickel types; also for welding stainless steels to mild steel and for welding steels which are air-hardened and cannot be heat treated after welding.

STANDARD ALLOY H-R (Nickel - chromium steel)—Standard Alloy Co., Inc., Cleveland, Ohio.

Low carbon, 18% chrome—8% nickel to high analysis such as 75% nickel—13% chrome; furnished in centrifugal tube castings and sand castings to specifications. Typical properties in untreated state: Ts, 70,000 psi; ys, 30,000 psi; elong in 2 in., 4-25%; Bhn, 170 (avg); sp gr (avg), 8.3; are resistant to acids, salts and atmospheres; max cont serv temp, 1800-2000 F; abrasion resistance, high. For conveyor drums and belts, rails, drive shafts, grids, trays, roller rails, rolls, boxes and pots, rolling mill parts, gasoline and oil cracking unit parts, etc.

STANDARD (Steel tubing)—Standard Tube Co., Detroit 3.

Tubing in SAE 1010-1035 carbon steels and 18-8 stainless steel types; for cold working, drawing and resistance welding. In cold-worked state: ts, 48,000 psi; ys, 35,000 psi; elong in 2 in., 25 per cent; hardness, rockwell B, 60-75; weldability, good. Available in a wide variety of shapes and sizes for uses such as roller conveyors, automotive parts, vacuum cleaner handles, washing machine rolls, etc.

STEATITE (Ceramic) — General Ceramics & Steatite Corp., Keasbey, N. J.

Furnished in finished parts, rods, tubes and plates. Abrasion resistance, high; resists corrosion caused by alkalies and acids; heat resistant to 1800 F; dielectric str, 300 volts per mil; ts, 9500 psi; comp str, 81,000 psi; moisture absorption, none; produced in white; impact resistance, 2.27 psi; sp gr, 2.7; opaque. For light bearings, radio frequency insulating parts, etc.

STEELMESH (Expanded metal) — Penn Metal Co. Inc., Boston 9, Mass.

Expanded steel sheet combining maximum strength with lightness. For machine guards, ventilation around motors, shelving, racks, drying trays, grating, filters, etc.

STERLING (Insulating varnishes)—The Sterling Varnish Co., Haysville, Pa.

A complete line of insulating varnishes for all types of electrical windings.

STERLING (Stainless steels)—Firth-Sterling Steel Co., McKeesport, Pa.

Standard stainless steels furnished to AISI specifications. For property and application data, see "Stainless Steels" listing at end of this section.

STERMET (Stainless and heat resistant steels)—Sterling Alloys, Inc., Woburn, Mass.

Standard stainless and heat resistant steel castings in AISI types. For type, property and application data see "Stainless steels" listing at end of this section.

STONEWALL (Asbestos cement board) — Rubberoil Co., New York 18.

Furnished in sheets; abrasion resistance, high; max cont. serv, temp. 450-500 F; nonflammable; flexibility, low; ts, 1900 psi; comp str, 10,000 psi; modulus of rupture, 3500 psi; moisture absorption, medium; available in natural gray, opaque; shatterproof; sp gr, 1.92. For electrical control bases, switch cells, etc.

STONEWALL (Babbitt) — United American Metals Corp., Brooklyn 22, N. Y.

Furnished in bars and pigs. In cold-worked state: Ts, 10,800 psi; comp str, 16,380 psi; ys, 8720 psi; elong in 2 in., 0.07 per cent; bhn, 24.3. For heavy-duty high-speed service.

STOODEX (Hard facing rod)—Stoody Company, Whittier, Calif.

Cast of Cr, Co, W, C and Fe. Rockwell C hardness, 49-51. Useful on parts subject to abrasion and impact and where smooth, thin deposits are required; clutch fingers, expeller parts, plow moldboards, etc. For oxyacetylene application.

STOODITE (Hard facing rod)—Stoody Company, Whittier, Calif.

Cast, of Cr, Mn, Zr, Si, C and Fe. Rockwell C hardness, 54-58. Used on parts subjected to sliding friction such as plowshares and steel mill guides. Polishes under abrasion, resists galling and pitting. For oxyacetylene and dc electric application.

STOODY (Hard facing rod)—Stoody Company, Whittier, Calif.

No. 1; a cast hard-facing rod of Co, Cr and W. Rockwell C hardness, 54. Has high resistance to abrasion and corrosion, even at red heat. Used for hard-facing underreamer lugs, carbon scrapers, wire guides, wood saw teeth, etc. For oxy-acetylene and ac-dc electric application.

No. 6; a cast hard facing rod of Co, Cr and W. Rockwell C hardness, 41-43. Has high abrasion, corrosion and impact resistance; these qualities retain at red heat; machinable with sintered carbide tools. Used for high-pressure, high-temperature valves, hot trimming dies, exhaust valves and seats, etc. For oxy-acetylene and ac-dc electric application.

STOODY SELF-HARDENING (Hard facing rod)—Stoody Company, Whittier, Calif.

A fabricated steel hard-facing rod containing Cr, Mn, Si, Mo, C and Fe. Rockwell C hardness, 52-56. Can be forged at red heat; forms excellent bond with manganese steel; has high resistance to severe abrasion and impact. Widely used for heavy construction equipment; crusher jaws, bucket lips, grader blades, etc. For oxyacetylene and ac-dc electric application.

STRAIN-TEMPERED (Cold finished steels)—Bliss & Laughlin Inc., Buffalo, N. Y.; Harvey, Ill.; Mansfield, Mass.

Medium and high carbon cold finished steels for high physical properties and increased ductility.

STRENES C (Gray iron)—The Advance Foundry Co., Dayton 3, O.

Alloyed high-strength gray iron furnished in sand castings. In untreated state: Ts averages 50,000 psi; Bhn, 220; and Charpy impact str, 70 ft- lb. Has fair weldability, medium abrasion resistance. Max cont. serv. temp, 1500 F. Used for cast stamping, forming and drawing dies, jigs, fixtures, die rings, cylinders, and all wearing surfaces as in machine tools.

STRESSPROOF (Manganese steel) — La Salle Steel Co., Hammond, Ind.

A severely cold-worked furnace-treated steel bar; C 0.40-0.48, Mn 1.35-1.65, P 0.045 max, S 0.24-0.33, Si 0.10-0.25; furnished in finished bars for machining. Ys, 100,000 psi min in sizes ⅜-in. to 2 in., and 90,000 psi min. in sizes over 2 in. through 3¼ in. Machines approximately 125 sfpm. Requires no heat treating but has replaced carbon and alloy carburizing steels. Available both cold drawn and ground and polished. Used for worm gears, lead screws, spindles, shafts, etc.

STRUX (Thermoplastic plastics)—E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

Cellulose acetate, thermoplastic, supplied in the form of extruded boards for lamination into structural panels. Very light panels with great structural strength are produced by laminating a "Strux" core to thin faces of wood, metal or fabric. Chemical properties equivalent to those of cellulose acetate; densities controlled in the range 4-8 pounds per cubic foot; form—stable to 390 degrees F. although maximum continuous service temperature is about 240 F. Used in aircraft panels, baggage, containers and boats.

STUPAKOFF (Ceramic)—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

No. 621; Seattle ceramic furnished in finished form made by molding, casting, machining, stamping, extruding. Abrasion resistance, high; resists corrosion caused by acids and alkalies, except hydrofluoric acid; dielectric strength, 200 volts per mil. inst.; ts, 9000 psi; comp str, 75,000; moisture absorption, low; available with colored glaze; sp gr, 2.6; opaque. For electrical insulating parts.

No. 1100; ceramic furnished in rods and tubes. Abrasion resistance, high; chemical resistance, good; max cont. serv. temp. 1800 F; noninflammable; flexibility, low, 7000 psi; comp str, 70,000 psi; flexural str, 18,000 psi; available in white to cream colors; opaque; shatterproof; sp gr, 2.56. For use in radio and high-frequency applications.

STYRON (Dow polystyrene plastics)—The Dow Chemical Co., Midland, Mich.

Thermoplastic; furnished in granules for molding; high clarity; low specific gravity; corrosion-resistant; dielectric strength, 5000 volts per mil at 1 mil, 500 volts per mil at 125 mil; ts, ult, to 10,000 psi; low moisture absorption; low inflammability; available in color; transparent. Used for insulators, decorative articles, structural parts, general injection molding, etc.

SUMET (High leaded bronzes) — Sumet Corp., Buffalo.

SM-8; Pb 24-27 per cent. For moderate speed and general service; suitable for machine tool bearings.

SM-10; Pb 22-25 per cent. For general applications such as aeronautical engines, clutch cones and disks, compressors, connecting rods, crank pins, etc.

SM-12; Pb 20-23 per cent. For cone and gyratory crushers, crane and ore machinery, mining machinery, etc.

SM-14; Pb 12-15 per cent. For thrust bearings, gears, etc.

SM-16; Pb 19-21. For heavy-duty service such as crane motor compressor, dredging machinery, etc.

SM-18; Pb 16.5-18.5 per cent. For crosshead pins, cranes, railroad, steam shovels, etc.

SUMMERILL (Seamless tubing) — Summerill Tubing Co., Carnegie, Pa.

Seamless tubing in practically all regularly used carbon grades from SAE 1010 to SAE 1095. Others are chrome molybdenum SAE 4130X, 4140, 4150, 4185, 52100, 4340, NE-8630, NE-8635, nickel-silver, pure nickel-silver, corrosion-resistant steels—18-8, 16-13-3 and similar grades; 4 to 6 per cent chrome with ½ moly; also some of 12-14 per cent chrome, beryllium copper, K-Monel and Invar. Available in any shape, and in sizes ranging from 0.012-in. to 5½ in. OD. Used for mechanical specialties, aircraft, industrial control instruments, fuel injection tubing for diesel engines, etc.

Also tapered and formed tubes for many special parts.

SUPER GRAPH (Carbon, graphite, and metal-graphite)—Superior Carbon Products, Inc., Cleveland, O.

Furnished in round and rectangular shapes and finished parts. For bearings, valve seats, brushes, seal rings, etc.

SUPERIOR (Copper-plated steel strip)—Superior Metal Co., Chicago 38.

Corrosion-resistant strip copper-plated and finished with natural copper, or polished or satin finished on one side. Furnished in coiled or straight strip for stamping. In cold-worked state: resists heat to 1400 F; resists corrosion caused by moisture; magnetic; max cont. serv. temp. 250 F. For parts requiring lubricating qualities of copper plate for involved drawing; or parts to be eventually nickeled or chrome-plated; or applications requiring strength of steel and appearance of polished or satin-finished copper.

SUPERIOR No. 3 (High alloy steel)—Braeburn Alloy Steel Corp., Braeburn, Pa.

Alloy steel having C 1.50, Cr 12.00, V 0.85, Mo 0.80; furnished in rough bars or billets and finished rods or bars, for machining. In heat-treated state; comp str, 550,000 psi; hardness. Rockwell C, 56-62. For forming rolls, lathe and grinder centers, etc.

SUPERIOR (Magnesium base alloy) — Superior Bearing Bronze Co. Inc., Magnesium Div., Brooklyn 22.

Magnesium castings for specific requirements.

SUPERIOR (Prefinished strip steel)—Superior Metal Works, Chicago 38.

Strip steel, prefinished, offered in the following types; Zincsteel, Chromsteel, Nickel Steel, Brass Steel, Copper Steel. Zincsteel used in electronic and aircraft industry, while the others are used in washing machines, automobiles, etc.

SUPERIOR (Seamless brass and copper tubing)—Penn Brass & Copper Co., Erie, Pa.

From 5/32-in. OD x 0.010-in. wall, to and including 1-in. OD x 0.072-in. wall; both in copper of pure electrolytic mixture and in brass of 3 alloys, namely; 70/30, 2-1 leaded, and 85/15.

SUPERIOR (Stainless strip steel)—Superior Steel Corp., Carnegie, Pa.

Hot and cold-rolled strip steel and stainless steels in all standard grades and analyses. For data on type, properties, characteristics, and applications see "Stainless Steels" listing at end of this section.

SUPERMAL (Malleable iron castings)—The Jeffrey Mfg. Co., Columbus, O.

C 1.60-1.80, Mn 0.20-0.40, Si 0.90-1.10, heat treated; ts, 60-70,000 psi; ys, 50-60 000 psi; elong in 2 in., 8 to 6%; Bhn, 179-201. For chain links, buckets, conveyor equipment, etc.

SUPER Y (Alloy malleable castings)—Chicago

Malleable Castings Co., 1225 West 120th St., Chicago 43, Ill.

Regular white iron with 1% Cu, and 0.30% Mo added. In normal annealed state, as, 60,000 psi; ys, 40,000 psi; elong in 2 in., 16%; Bhn, 143.

SURCO AMERICAN (Thermosetting plastics)—Suprenant Electrical Insulation Co., Ben, Mass.

Furnished in sheets, rods or tubes; for molding, stamping and extruding. Abrasion resistance as required; resists corrosion caused by acids and other corrosion elements; heat resistant to the degree required; flexibility as required; dielectric str, 1500 volts per mil avg; ts, 200-4500 psi; moisture absorption, low; available in 26 colors; shatterproof; sp gr, .90-1.45; opaque; machinability, good. For control cables, etc. in machine tools.

SUVENEER (Clad steel)—Superior Steel Corp., Carnegie, Pa.

Steel clad on one or both sides with stainless, nickel, Monel, copper, and some copper-base alloys, etc; furnished in strips; for stamping, welding, deep drawing, rolling, spinning, soldering, etc.

SWEET HOME BRAND (Resin-bonded plywood)—Oregon Plywood Co., Sweet Home, Oregon.

Phenolic resin-bonded, thermosetting fir plywood, machined into parts; moisture and water resistant. Used for aircraft cabinets, instrument panels, bases, bodies, bolts, etc..

SYNFLEX (Rubber-like synthetics) — Industrial Synthetics Corp., Garwood, N. J.

Polyvinyl chloride and polyvinyl copolymers; thermoplastics; in rods, tubes, shapes and tapes. Abrasion resistance, high; resists corrosion caused by weak and strong inorganic acids, sulphuric acids and alkalies; heat resistant to 230 F; flexibility, high; dielectric strength to 3600 volts per mil, ts, to 3600 psi; moisture absorption, low; shatterproof; sp gr, 1.18-1.48; transparent, translucent and opaque. Four outstanding compounds as well as special compounds for specific applications are available, such as window channel, mechanical rubber goods, electrical insulation, communications, etc.

SYNTHANE (Phenolic laminated plastics)—Synthane Corp., Oaks, Pa.

Thermosetting, corrosion resisting; furnished in sheets, rods and tubes, fabricated parts, and in parts made by molding the impregnated base materials. Available in following grades:

X; Kraft paper base, hard resin, laminated material; for mechanical applications where electrical requirements are of secondary importance; ts, 12,500 psi.

XP; Kraft paper base, plasticized resin, laminated material, primarily intended for punching; more flexible and not quite as strong as Grade X; moisture resistance and electrical properties intermediate between Grades X and XX.

XX; cotton rag paper base laminated material; hard, greater percentage of resin than Grade X. Suitable for usual electrical applications; good machinability.

XXP; cotton rag paper base laminated material; similar to Grade XX in electrical and moisture-resisting properties, but more suitable for hot punching. Intermediate between Grades XP and XX in punching and cold flow characteristics.

XXX; cotton rag paper base laminated material; suitable for radio frequency work, for high humidity applications; minimum cold flow characteristics.

XXXP; cotton rag paper base laminated material; similar to Grade XXX but with lower dielectric losses and more suitable for hot punching; greater cold flow than Grade XXX, and intermediate between Grade XXP and XXX in punching characteristics.

C; heavy weave fabric; base laminated material made throughout from cotton fabric weighing over 4 oz per sq yd, and having a count of not more than 72 threads per in. in the filler direction, nor more than 140 threads per in total in both warp and filler direction. Strong, tough material suitable for gears and other applications requiring high impact strength. Available in subgrades, depending upon sizes of gears and types of mechanical service. Should not be used for electrical applications.

CE; heavy weave fabric base laminated material, same as Grade C. For electrical applications requiring greater toughness than Grade XX, or mechanical applications requiring greater resistance to moisture than Grade C.

L; fine weave fabric base laminated material, of cotton; suitable for small gears and other fine machining applications, particularly in thickness under ½-in. Not quite as tough as Grade C; should not be used for electrical applications except for low voltage.

LE; fine weave fabric base laminated material, same as Grade L; for electrical applications requiring greater toughness than Grade XX; better machining properties and finer appearance than Grade CE. Also available in thinner sizes. Exceptionally good in moisture resistance.

SYNTHOLVAR (Thermoplastic plastics)—Varflex Corp., Rome, N. Y.

Vinyl chloride acetate type furnished in form of tubes; abrasion resistance, high; dielectric strength (volts per mil inst.), 700-1000; ts, 2500-3000 psi; moisture absorption, low; available transparent and opaque; hardness, Shore Durometer, 80-85. Used as insulation by manunfacturers of many types of electrical equipment.

SYROCOWOOD (Molded wood)—Syracuse Ornamental Co. Inc., Syracuse, N. Y.

Thermosetting and thermoplastic; furnished as molded parts. Abrasion resistance, low; flexibility, low; opaque. For nameplates or decorative parts, also for radio type control knobs.

T

TALIDE (Tungsten carbide) — Metal Carbides Corp., Youngstown, O.

Furnished in rough bars or billets, finished rods or bars, tubing, permanent mold castings, and powder metals. Is self-hardening during processing; heat treated, ts, 300,000 psi; comp str, 750,000 psi; impact strength (Charpy), 1.10; hardness, Rockwell C, 90-92; sp gr, 14.60; is nonmagnetic; weldability, good; resists most acids and chemicals; max cont serv temp, 2000 F; abrasion resistance, high. Maintains cutting edge while red hot. Used for cutting tools, drawing dies, drill jig bushings, lathe and grinder centers, centerless grinder blades, sand blast nozzles, guides, wear-resistant plates, etc.

TAMCO (Rimming steel)—Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Alloys including original high and medium-carbon ferro carbon-titanium, foundry ferro titanium, and several varieties of low-carbon ferro-titanium for rolled, cast and forged steels, stainless and alloy steels, and gray cast iron.

TAYLOR FIBRE (Phenolic laminated plastics)—Taylor Fibre Co., Norristown, Pa.

Thermosetting; furnished in laminated sheets, rods and strips for machining into parts. Abrasion resistance, medium and high; chemically resistant to most common solvents; max cont. serv. temp, 200 F; nonflammable; flexibility, high; dielectric str, 300 volts per mil; ts, 7500 psi; comp str, 25,000 psi; flexural str, 13,000 psi; available in red, gray, black and white; shatterproof; sp gr, 1.25; opaque; bhn, 25. Used for electrical insulation and wherever high arc resistance is required.

TAYLOR PHENOL FIBRE (Laminated phenolic plastics)—Taylor Fibre Co., Norristown, Pa.

Grade C; furnished in sheet, strip, rods or tubes; abrasion resistance, high; resists caustic solutions to 2% concentration, acid solutions to 10% concentration and common solvents; max cont serv temp, 200 F; is slow burning; flexibility, low; dielectric strength (volts per mil inst.), 200; ts, 7500 psi; comp str 38,000 psi; elong, 2%; moisture absorption, low; produced in natural and black; has high impact strength; sp gr, 1.36; is opaque; machinability, good; hardness, Rockwell M-108. For gears, cams, structural parts, etc.

Grade XX; sheets, tubes, and rods; abrasion resistance, high; resists caustics up to 1% concentration; acids up to 5-10% concentration and common solvents; max cont serv temp, 225 F; is slow burning; flexibility, low; dielectric strength, $\frac{1}{16}$ in. thick, (volts per mil inst.), 500; ts, 9000 psi; comp str, 34,000 psi; transverse strength, 16,000 psi; elong, 1%; moisture absorption, low; produced in natural and black; has medium shock resistance; sp gr, 1.36; is opaque; machinability, good; hardness, Rockwell M, 110. For terminal blocks, panels, washers, coil forms, etc.

Grade XP; furnished in sheets, rods and tubes; abrasion resistance, medium; is not recommended for chemical application; max cont serv temp, 225 F; flexural strength (ASTM D 650-42-T) 15,000 psi; dielectric strength, $\frac{1}{16}$ in. thick (volts per mil inst.), 500; ts, 8000 psi; comp str, 22,000 psi; produced in natural and black; moisture absorption, low; sp gr, 1.36; is opaque; machinability, good; Bhn, 30. For washers, punchings, etc.

Grade GMG furnished in laminated sheets, rods and tubes; abrasion resistance, medium; resists caustic concentration 1%, acid concentration 10-20%, and common solvents; max cont serv temp, 350 F; flexural strength (ASTM D 650-42T). 40,000 psi; dielectric strength, $\frac{1}{16}$ in. thick (volts per mil inst.), 300; ts, 35,000 psi; comp str, 80,000 psi; produced in natural gray color; moisture absorption, low; sp gr, 1.95; is opaque; machinability, fair; Bhn, 40. Has high temperature and arc resistance. For panel boards, structural parts, etc.

Grade XXXP; furnished in sheets, strips and plates; abrasion resistance, medium; resists caustic concentration 1%, acid concentration 5-10%; and common solvents; max cont serv temp, 225 F; is slow burning; flexibility, low; dielectric strength $\frac{1}{16}$-in. thick (volts per mil inst.), 500; ts, 7000 psi; comp str, 25,000 psi; elong, 1%; moisture absorption, low; produced in natural and black; is not shatterproof; sp gr, 1.30; is opaque; machinability, good; hardness, Rockwell M, 95-100. For switch bases, stators, condenser bases, etc.

Grade LE; furnished in laminated sheets, rods and tubes; has fine weave fabric base; abrasion resistance, high; resists caustic concentration to 2%, acid concentration to 10%, and common solvents. Max cont serv temp, 200 F; flexural strength (ASTM D 650-42T), 15,000 psi; dielectric strength, $\frac{1}{16}$ in. thick (volts per mil inst.), 400; ts, 8500 psi; comp str, 37,000 psi; produced in natural and black; moisture absorption, low; sp gr, 1.36; is opaque; machinability, good; Bhn, 36. For gears, cams, structural parts, etc.

TEFLON (Thermoplastic plastics)—E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

Polytetrafluorethylene, thermoplastic; furnished in sheets, rods, tubes and coatings on wire. Resistant to all chemicals including highly corrosive acids; max cont. serv. temp, 500-550 F; flexural str, 2000 psi (ASTM D 650-42T); dielectric str, 480 volts per mil; ts, 2000-4500 psi; comp str, 1700 psi; impact str, 4.0 ft-lb (Izod); produced in light colors; moisture absorption, low; sp gr. 2.1-2.3; translucent and opaque; machinability, good. For gaskets, packings, bearings, gears, wire insulation, conduits, and tubing.

TEGIT (Cold-molded plastics) — Garfield Mfg. Co., Garfield, N. J.

Tan colored, cold-molded plastics; corrosion resistant; high dielectric strength; moisture absorption, less than 1%; heat resistance, 300 F; impact-resistant; resists hot oil, boiling water and ordinary chemicals; will not shrink, crack, warp or deteriorate with age. Used for heavy-duty wiring devices and small insulated parts.

TEGO (Plastics resins) — Resinous Products & Chemical Co., Philadelphia 5.

Synthetic resin adhesive, phenolic resin film, dry sheet. Has low moisture absorption, high density. Used in manufacture of waterproof plywood for aircraft and marine use.

TELNIC (Bronze)—Chase Brass & Copper Co., Waterbury 91, Conn.

Cu 98.3, Ni 1.0, P 0.02, Te 0.5. A hard high-strength forgeable, age-hardenable, machinable bronze for general engineering structural uses.

TEMPALOY (Copper-aluminum-nickel alloy) — American Brass Co., Waterbury, Conn.

Alloys which respond to heat treatment; abrasion resistant. Uses include motorboat shafting, piston rods, bearing applications, etc.

TENITE (Thermoplastic plastics) — Tennessee

Eastman Corp., Kingsport, Tenn.

I; cellulose-acetate base, thermoplastic; furnished in granular and pellet form; available in clear transparent and colors, plain, variegated, translucent and opaque; high impact strength; high polish. Used for compression and injection molding decorative and industrial products, also extruded in form of strips, rods and tubes.

II; cellulose acetate butyrate base, thermoplastic; furnished in granular and pellet form; has greater dimensional stability than cellulose acetate plastic because of lower moisture absorption; contains less plasticizer than cellulose acetate plastic and the plasticizer used has greater retentivity; available in clear transparent and colors; plain, variegated, translucent and opaque; high impact strength; high polish. Used for compression and injection molding of decorative and industrial products, also extruded in form of strips, rods and tubes.

III; cellulose-acetate propionate thermoplastic furnished in form of granules and pellets for injection molding and extruding. Abrasion resistance, medium; has greater dimensional stability than cellulose acetate plastics and less than Tenite II; max cont serv temp, 170 F; flexural strength (ASTM D 650-42T), 5,000-12,000 psi; ts, 3000-5800 psi; produced in all colors; sp gr, 1.18-1.22; produced transparent, translucent, and opaque; machinability, good.

TENSILASTIC (Rubber and rubber synthetics)—American Wringer Co. Inc., Woonsocket, R. I.

Hard and soft rubber and rubber synthetics for rolls and linings and covering of tank parts, etc. Available in any size from ½-in. long and ½-in. in diam to 300 in. long and 44 in. in diam; any density from dead hard to very soft; compounded to meet mechanical and chemical requirements; heat resistant to 180 F; flexibility, high; moisture absorption, low.

TENUAL (Aluminum alloy castings) — National Bronze & Aluminum Foundry Co., Cleveland.

No. 9; Si 4.50-6.00, low impurities, balance Al; furnished as sand or permanent-mold castings. In untreated state: Ts, 19,000 psi; comp str, 10,000 psi; ys, 9000 psi; elong in 2 in., 5.0 per cent; impact str, 1.0 ft-lb (Charpy); endurance limit (completely reversed bending), 6500 psi; bhn, 40; sp gr, 2.70; nonmagnetic; weldability, good; max cont. serv. temp, 250 F. For various corrosion resisting parts.

No. 50; Cu 8.0, Fe 1.0, Si 1.2, balance Al; furnished as sand and permanent-mold castings. In untreated state: Ts, 23,000 psi; comp str, 14,000 psi; ys, 14,000 psi; elong in 2 in., 2.0 per cent; impact str, 0.6 ft-lb (Charpy); endurance limit (completely reversed bending), 8000 psi; bhn, 65; sp gr, 2.83; max cont. serv. temp, 250 F. For general purpose castings.

No. 54; Cu 4.0, Mg 1.5, Ni 2.0, balance, Al; furnished as sand and permanent-mold castings. In heat-treated state: Ts, 37,000 psi; comp str, 47,000 psi; ys, 32,000 psi; sp gr, 2.77; nonmagnetic; weldability, good; max cont. serv. temp, 350 F; abrasion resistance, high. For parts subjected to elevated temperatures.

No. 64; Si 7.0, Mg 0.3, balance Al; furnished as sand and permanent-mold castings. In heat-treated state: Ts, 33,000 psi; comp str, 22,000 psi; ys, 24,000 psi; elong in 2 in., 4.0; sp gr, 2.68; nonmagnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 300 F. For intricate parts requiring high strength.

No. 105; Cu 4.0, balance Al; furnished as sand castings. In heat-treated state: Ts, 36,000 psi; comp str, 25,000 psi; ys, 24,000 psi; elong in 2 in., 5.0; impact str, 1.8 ft-lb (Charpy); sp gr, 2.78; nonmagnetic; weldability, good; max cont. serv. temp, 300 F. For castings where design is not intricate and high strength is needed.

TERNALLOY (Aluminum alloys)—The National Smelting Co., Cleveland 5, Ohio.

No. 6; nominal composition; Mg 1.8, Zn 3.6, Mn 0.4, Cr 0.3; furnished in ingots for sand, permanent-mold, precision castings. Typical properties, as-cast, ts, 35-38,000 psi; ys, 20-23,000 psi; elong, 4-12%; Bhn, 70-75; sp gr, 2.76; nonmagnetic; weldability, good. For use where high strength, ductility, dimensional stability, and good machinability are required. Used primarily in the as-cast condition.

No. 7; nominal composition; Mg 2.1, Zn 4.2, Mn 0.4, Cr 0.3; furnished in ingots for sand, permanent-mold, and precision castings. Typical properties, as-cast; ts, 36-41,000 psi; ys, 23-26,000 psi; elong, 3-10%; Bhn, 75-90; sp gr, 2.76; nonmagnetic; weldability, good. For use where high strength, ductility, dimensional stability, and good machinability are required.

No. 8; nominal composition; Mg 2.4, Zn 4.6, Mn 0.4, Cr 0.3; furnished in ingots for sand, permanent-mold, and precision castings. Typical mechanical properties, heat treated, for permanent-mold castings, ts, 58,000 psi; ys, 52,000 psi; elong, 3.0%; Bhn, 110; sp gr, 2.78; nonmagnetic, weldability, good. For use where high strength, ductility, dimensional stability, and good machinability are required.

TETON (Carbon-chrome tool steel) — Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A 1.00-carbon 1.25-chrome tool steel that is rather deep hardening and develops high compressive strength. Used for hardened machine parts subject to wear without severe shock. Usually hardened in oil.

TESCO (Electric steel castings) — Tonawanda Electric Steel Casting Corp., North Tonawanda, N. Y.

Grade B cast steel, low carbon; furnished in sand castings to specification; ts, 70,000 psi (min); ys, 36,000 psi (min); elong in 2 in., 24%

TEXRUB (Rubber-like vinyl base material)—M. B. Price Associates, New York.

Rubber-like vinyl-base, thermosetting and thermoplastic materials, furnished in laminated sheets, rods or tubes; for molding, casting, machining, stamping and extruding into parts; abrasion resistance, high; resist corrosion caused by water, gas, oils, alkalies, uric acid and 30% sulphuric acid and ozone; soften at 240 F; melt at 330; flexibility, good; ts, 2500 psi. Available in black, white, gray, red, brown and green; translucent and opaque; shatterproof; sp gr, 1.26. Used for chemical tubing and piping, etc.

TEXTOLITE (Plastics materials)—General Electric Co., Chemical Department, Pittsfield, Mass.

Phenolic, urea, melamine, cellulose acetate butyrate, polystyrene, methyl methacrylate, vinyl chloride-acetate, polyamides; thermosetting and thermoplastic materials; compression, injection, extrusion, and transfer molded; cast; laminated; sheets, rods, tubes, bearings, fabricated parts; abrasion and corrosion resistant; ts, 3500-20,000 psi; dielectric strength, 60-1000 volts per mil; heat resistant to 302 F; resistant to shock; flexible in some grades; available in color; takes high polish; transparent and translucent in some grades; sp gr, 1.07-2.03. Used for electrical or thermal insulation, structural parts, gears, cams, bearings, housings, knobs, etc.

THERMO-CAST (Plastics tooling material) — Ernst Bischoff Co. Inc., Plastic Division, Memphis, Tenn.

An ethyl-cellulose base thermoplastic embodying good flow characteristics at melt temperature, retention of exact mold dimensions and high degree of durability, toughness and acid resistance. Pouring temperature, 380-420 F; comp str to failure, 5000-12,000 psi; cold mold shrinkage (inch per inch), 0.001-0.006; coefficient of thermal expansion (inch per inch per degree C), 0.0005-0.0001; ts, 800-3300 psi; modulus of elasticity, 50,000-100,000 psi; flexural strength, 2000-5000 psi; water absorption, 0.22-0.35% in forty-eight hours; machinability, good; castability, excellent. Used for casting into forming blocks, drill jigs, dies and other tools.

THERMALLOY (Alloy cast steels)—Electro-Alloys Division, American Brake Shoe Co., Elyria, O.

Grade 85; heat-resistant alloy furnished as sand castings to specification; Ni 64-70, Cr 17-20, Si 1-2, Mn 0.75-1.25, C 0.45-0.65. Nonmagnetic; weldability, fair to good; resists corrosion by hot gases, except those high in sulphur; max cont. serv. temp, 2000 F. For heat treating boxes and trays, retorts, enameling furnace supports, furnace conveyor parts, burner parts, etc.

Grade 72; heat-resistant alloy furnished as sand castings to specification; C 0.45-0.65, Mn 0.75-1.25, Si 1-2, Cr 12-15, Ni 58-64. In untreated condition: Ts is 62-80,000 psi; ys, 30-40,000 psi; elong in 2 in., 15-3 per cent; bhn, 170-210; nonmagnetic; weldability, fair to good; resists corrosion by hot gases, except those high in sulphur; max cont. serv. temp, 2000 F. For general furnace parts, heat treating boxes and trays, retorts, enameling furnace supports, furnace conveyor parts, burner parts, etc.

Grade 50; heat-resistant alloy furnished as sand castings to specification; C 0.45-0.65, Mn 0.75-1.25, Si 1-2, Cr 15-18; Ni 34-37. Ts, 55-75,000 psi; ys, 32-55,000 psi; elong in 2 in., 20-4; bhn, 150-195; nonmagnetic; weldability, fair to good; resists corrosion by hot gases except those high in sulphur; max cont. serv. temp, 2000 F. Used for furnace retorts, heat treating and carburizing boxes, burner parts, conveyor chain, furnace supports, etc.

Grade 40; heat-resistant alloy furnished as sand castings to specification; C 0.3-0.4, Mn 0.75-1.25, Si 1-1.75, Cr 26-28, Ni 10-13. Ts (untreated), 65-95,000 psi; ys, 36-55,000 psi; elong in 2 in., 30-4; bhn, 170-260; nonmagnetic or weakly magnetic; weldability, good; resists corosion by hot gases; max cont. serv. temp, 2000 F. For shafts, disks, beams, chain rollers and other heat-treating furnace parts; oil still tube supports; dampers and valves; paper-mill digester parts; burner tips and nozzles; rabble arms, and blades; furnace buggies; lead parts, etc.

Grade 30; heat-resistant alloy furnished as sand castings to specification; C 0.25-0.35, Mn 0.75-1.25, Si 0.75-1.75, Cr 19-22, Ni 7.5-10. Untreated: Ts, 75-100,000 psi; ys, 40-50,000 psi; elong in 2 in., 40-20; bhn, 170-210; nonmagnetic or weakly magnetic; weldability, good; corrosion resistant to hot gases and corrosive liquids; max cont. serv. temp, 1600 F. For mine water and acid pump parts, chemical mixer parts, marine fittings, oil still supports, etc.

Grade 38; heat-resistant alloy furnished as sand castings to specification: C 0.3-0.4, Mn 0.75-1.25, Si 0.75-1.75, Cr 27-30, Ni 7-10. Untreated: Ts, 85-110,000 psi; ys, 40-75,000 psi; elong in 2 in., 18-2 per cent; bhn, 200-270; magnetic; weldability, good; resists corosion by hot gases; max cont. serv. temp, 2000 F. Suitable for same type parts as Grade H.

Grade 47; heat-resistant alloy furnished as sand castings to specification: C 0.3-0.4, Mn 0.75-1.25, Si 1 25-2.25, Cr 24-27, Ni 19-22. Untreated: Ts, 65-95,000 psi; ys, 40-70,000 psi; elong in 2 in., 25-12; bhn, 160-195; nonmagnetic; weldability, good; resists corrosion by hot gases. For general furnace parts and carburizing containers.

Grade 28; heat-resistant alloy furnished as sand castings to specification; C 0.2-0.4, Mn 0.75-1.25, Si 0.75-1.75, Cr 26-29, Ni 3.0 max. Untreated: Ts 65-95.000 psi; ys, 45-55,000 psi; elong in 2 in., 5-0 per cent; bhn, 170-240; magnetic; weldability, fair; resists corrosion caused by hot gases. For lead pots, sintering bars, grate bars and tuyeres, roaster furnace rabble arms and blades.

THERMOPANE (Glass with metal edge seal)—Libbey-Owens-Ford Glass Co., Toledo, O.

Metal-to-glass edge-sealed with dehydrated dead-air space; furnished in flat units; abrasion resistance, high; resists corrosion; heat resistant to 150 F; flexibility, low; modulus of rupture, 6500 psi; nonflammable; moisture absorption, low; sp gr, 2.52; coefficient U for double-glass Thermopane with ¼-in. or ½-in. airspace approx 0.58 to 0.65; transparent and translucent. For insulated observation windows.

THERMOPLAX (Cold-molding plastics)—Cutler-Hammer Inc., Milwaukee.

Bituminous base compounded with filler such as asbestos; cold-molded into parts; heat resistant to 400-600 F; nonflammable; dielectric str, 80-100 volts per mil; resistant to corrosion; takes high polish; ts, 2000-4000 psi; moisture absorption, 2 per cent. Used for electrical and heat insulation.

THINSTEEL (Carbon, alloy and stainless strip steel) — The Cold Metal Products Co., Youngstown, Ohio.

Most grades of carbon and alloy steels in strip form, including stainless steels. For property and application data, see "Stainless Steels" listing at end of this section.

THIOKOL (Synthetic rubber)—Thiokol Corp., Trenton, N. J.

Available in four types; crude, corresponding to crude rubber, water dispersions for coatings, liquid polymers, and molding powders; processed in manner similar to rubber; oil corrosion and solvent resistant. Used for hoses carrying oil or gasoline, gaskets, packing, pipeline rings, diaphragms, newspaper printing blankets, etc.

THOMASTRIP (Cold-rolled strip steel)—Thomas Steel Co., Warren, Ohio.

Bright finish electro-coated in brass, nickel, zinc, and copper. Hot-dipped tin and solder. Lacquer coated in colors. Carbon and alloy specialties.

TIGERLOY (Alloy cast steel)—Massillon Steel Castings Co., Massillon, O.

Nickel-molybdenum; for shovel castings, gears, crane track wheels, castings for impact resistance, etc.

TIMKEN (Steels)—The Timken Steel & Tube Div., Timken Roller Bearing Co., Canton, Ohio.

All standard AISI types of alloy and stainless steels in standard forms. Also AISI carbon steels for mechanical tubing. For property and application data on stainless steels, see "Stainless Steels" listings at end of this section.

91140 Steel; an alloy steel containing 0.40-0.70 graphitic carbon; furnished in ingots, rough bars and billets, finished rods or bars, straight and coiled strip, wire, sheet, and plates. In heat treated state, ts, 164,000 psi; ys, 136,000 psi; elong in 2 in., 13%; Bhn, 302; weldability, good; abrasion resistance, high. For spindles, lathe ways, gears, valve tappets, pneumatic hammer parts, etc.

TI-NAMEL (Vitreous enameling steel)—Inland Steel Co., Chicago 3.

Low-carbon titanium vitreous enameling steel furnished usually in sheet or strip, but may be obtained in plates or bars. Produced primarily for its vitreous enameling characteristics. Can be used in hot and cold working, stamping, drawing, brazing, and welding. Used for food and dairy machinery, beverage machinery, washing machines, refrigerators, stoves, etc.

TI-NIC-O-SIL (Nickel-silver forging alloys)—Titan Metal Mfg. Co., Bellefonte, Pa.

No. 14; has excellent white color; not quite as forgeable as No. 53. Ts, over 85,000 psi. Composition: Cu 31-44, Ni 15-20, Zn balance.

No. 53; contains about 10% nickel, forges with same ease as forging-quality brass. Close forging tolerances can be held. For forged parts requiring white color and good corrosion resistance combined with moderate strength.

No. 54; nickel-silver, white color; Cu 46.85, Pb 2.50, Mn 2.00, Ni 11; balance Zn. Exceptional corrosion resistance; high strength; free machining; takes high polish. For hardware, valve parts, bottling machines, automobile accessories, electrical contacts, etc.

TISCO (Alloy steels and magnet metals)—Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Manganese steel; C 1.00-1.40, Mn 11.0 min, Si 1.0 max, S 0.05 max, P 0.10 max. Furnished as sand castings. Ts, 80-120,000 psi; ys, 40-50,000 psi; elong in 2 in., 15-35%; Bhn, 180-200; nonmagnetic; max cont serv temp, 300 F; abrasion resistance, high. For wearing parts for excavating, crushing and reduction machinery.

Timang; manganese-nickel steel; C 0.60-0.80, Mn 13.0-15.0, Ni 2.75-3.25; furnished in finished rods or bars, wire and plate, and as sand castings; for arc welding. Ts, 135-155,000 psi; ys, 45-55,000 psi; elong in 2 in., 50-80 per cent; endurance limit (completely reversed bending), 50,000 psi; bhn, 170-210; nonmagnetic; weldability, good; max cont. serv. temp, 500 F; abrasion resistance, high. For welding rods and abrasion-resisting plates and screens.

Alnico; magnet metal; of aluminum, nickel, cobalt and iron; furnished as sand castings. In untreated state: Ts, 4197 psi; sp gr, 6.9; highly magnetic; corrosion and abrasion resistance, high. Used for permanent magnets.

Alloy No. 80; Nickel-chromium-molybdenum steel furnished as sand castings; in heat treated state, ts, 173,000 psi; ys, 165,000 psi; elong in 2 in., 8%; Bhn, 350; is magnetic; weldability, fair; abrasion resistance, high. For crushing parts, sand pumps, and various castings subjected to abrasion without shock.

Alloy No. 23X; medium manganese-chromium-molybdenum steel; furnished as sand castings to specification; in water-quenched, heat-treated state, ts, 90-110,000 psi; ys, 68-90,000 psi; elong in 2 in., 20-30%; Bhn, 210-260; weldability, good; abrasion resistance, medium. For structural applications where high strength and shock resistance are required.

TITAN (Bronze welding rod)—Titan Metal Mfg. Co., Bellefonte, Pa.

Bronze welding rods, as follows:

Bronze; flows at 1617 F, is low fuming and has been doubly deoxidized.

Naval bronze; flows at 1615 F.

Wearwell; flows at 1593 F. A special purpose rod processing great hardness. Rods are not furnished under ¼-in. diam.

These rods are tin bronzes and work well on cast iron; have good hardness, a fair amount of ductility and good corrosion resistance.

Manganese bronze; flows at 1617 F, is low fuming and has been doubly deoxidized.

Naval manganese bronze; flows at 1620 F.

The above two welding rods contain iron, manganese, nickel, etc., in addition to tin. Good general-purpose rods, specifically recommended for cast iron; produce rigid welds; able to withstand distortion.

Also following corrosion-resistant rods:

Manganese; a forgeable bronze, Cu 59.25, Mn 0.40, Sn 0.90, Fe 0.90, balance Zn. Conforms to chemical requirements of U. S. Navy Spec. 46B-15-C.

Naval Bronze; forgeable; Cu 60.25, Sn 0.75, balance Zn. Has high strength; is corrosion resistant. For valve parts, etc.

Also produce Muntz Metal (see listing under "Muntz Metal" in this section), free-machining brass and bronze rods.

TITANATES (Ceramic)—General Ceramics & Steatite Corp., Keasbey, N. J.

Furnished in sheet, rods, tubes and plates. Abrasion resistance, high; max cont serv temp, 1700 F; nonflammable; flexibility, low; dielectric str, 185 volts per mil; transverse str, 15,000 psi; moisture absorption, low; available in straw color, opaque; sp gr, 6-7. Used as dielectric material in manufacture of condensers.

T-LOYS (Steel castings)—Unitcast Corp., Steel Casting Div., Toledo 9, O.

No. 4; abrasion-resistant, silicon-molybdenum steel with excellent hardening properties. Used for mining tools, wear plates, crusher plates and pinions.

No. 6; air-hardening die steel of uniform machining qualities; long life under severe wear.

No. 131; C 0.22-0.28, Mn 0.7-0.8, Cu 1-1.2. V 0.04-0.08, Si 0.4-0.5; furnished in castings. Ts, 90-100,000 psi; ductility, high. For use where high strength and ductility is desired rather than hardenability.

No. 135; C 0.30-0.37, Mn 0.70-0.85, Ni 0.70-0.95, Cr 0.50-0.70, Mo 0.18-0.25; furnished as castings to meet 4B, 4C2, 4C3 Army Specifications. Can be oil or water-quenched. General physical specifications: Ts, 100,000 psi; ductility, high; bhn, 217-241; machinability, good.

No. 135H; C 0.37-0.45, Mn 0.70-0.85, Ni 1.00-1.25, Cr 0.70-0.85, Mo 0.25-0.35. Has higher strength and hardenability. Will oil quench to higher and deeper hardness. Used for wear plates, scarifier teeth, etc. Machinability, good at 220-260 Brinell.

TOBIN (Bronze)—American Brass Co., Waterbury, Conn.

Cu 60, Zn 39.25, Sn 0.75; abrasion-resistant. Uses include piston rods, boat shafting, condenser head plates, welding rods, seamless tubes, etc.

TOMBASIL (Copper-base alloys)—Ajax Metal Co., Philadelphia 23, Pa.

A; Cu 81.5, Si 4.8, Zn 13.7. In untreated state: Ts, 65,000 psi; ys, 40,000 psi; elong, 15 per cent; bhn, 140; sp gr, 8.25; nonmagnetic; weldability, good.

Navy; analysis in accordance with Navy Dept. Spec. 46B28. Cu 90, Si 5 max, Zn 5. In untreated state: Ts, 55,000 psi; ys, 20,000 psi; elong, 40 per cent; bhn, 105; sp gr, 8.25; nonmagnetic; weldability, good.

TONCAN (Iron)—Republic Steel Corp., Cleveland 1.

An open-hearth iron alloyed with 0.40 per cent min copper and 0.05 per cent min molybdenum. Resists corrosion caused by atmosphere, water, oils and process materials; ts, 48-58,000 psi min; comp str, 40,000 psi; bhn, 90-120. For sheet-metal applications.

TOOLWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

Type 60; coated arc welding electrode, deposited hardness of 60-65 rockwell C; hardness retained to 1000 F; deposit can be heat treated same as high-speed steel. For building hard, tough cutting edges on cold-rolled steel and for other applications requiring super-hardness.

TOPHET (Nickel-chromium alloys)—Wilbur B. Driver Co., Newark, N. J.

Type A; approx. 80 Ni and 20 Cr; resists heat to 2100 F. Supplied in wire and strip form; for electrical heating applications.

Type C; Ni 60, Cr 15, and balance Fe; resists heat to 1800 F. Supplied in wire and strip form; for electrical resistance and heating application.

TRANSFLEX (Thermoplastic plastics)—Irvington Varnish & Insulator Co., Irvington, N. J.

Polyvinyl chloride; furnished in tubing and rods for extruding. When used as conduit permits quick identification of coded enclosed leads and location of wire breaks; unusual elongation facilitates stretching over lugs, splices and other projections; does not become brittle at temperatures as low as —58 F; max cont serv temp, 170 F; ts, 3000 psi; dielectric str, 1000 volts per mil (dry); 800 volts per mil (wet); for tubing wall thickness approximately 0.020-in.; sp gr, 1.2; moisture absorption, low. Designed for moderately low temperature applications; wire insulation, conduit, etc.

TRANTINYL (Alloy steels)—Youngstown Alloy Castings Corp., Youngstown, O.

Furnished as sand castings. High abrasion resistance; medium ductility; high tensile strength. Used for tools for tube and bar mills such as guide shoes, plugs, guides, etc.

TREMBRONZE (Bronze strip)—The Miller Co., Meriden, Conn.

Strip bronze furnished in coils; Cu 92, Sn 2, P 0.15, balance, zinc. In cold worked state, ts, 91,000 psi; ys, 82,000 psi; elong in 2 in., 2%; hardness, Rockwell C, 85-88; sp gr, 0.32; is nonmagnetic; weldability, good; max cont serv temp, 350 F; abrasion resistance, medium. Used with excellent results in the manufacture of electrical control equipment, switches, etc.

TRENITE (Cast iron)—Trenite Corp., Trenton, N. J.

Furnished as sand castings to specification; heat treatment unnecessary; ts, 45,000 psi; Bhn, 275; is magnetic; weldability, good; abrasion resistance, high.

TRENTWELD (Stainless tubing)—Trent Tube Mfg. Co., East Troy, Wis.

Austenitic stainless steels, in welded tubing. Recommended heat treatment, standard annealing practice for austenitic stainless steels. Ts, 75,000 psi min; ys, 40,000 psi min; elong in 2 in., 35 per cent; hardness, rockwell B, 80 max; nonmagnetic. For use where corrosive environment is such that stainless steels are required. Also produces Inconel tubing for applications requiring heat resistance.

TRI-CORE (Rosin filled solder)—Alpha Metals, Inc., 363 Hudson Ave., Brooklyn 1, N. Y.

Various tin-lead solders for use wherever non-corrosive fluxes are demanded.

TRIPLE A ALMAG (Aluminum alloy castings)—Acme Aluminum Alloys, Inc., Dayton 3, O.

55; Al, Mg and other elements giving special properties. Highest combination of ultimate strength, ductility, and impact resistance. Heat treated properties: Ts, 50,000 to

60,000 psi; ys, 28,000 to 35,000 psi; elong in 2 in., 16 to 30%; impact str, 6 to 8.5 ft lb (Charpy); sp gr, 2.56. High corrosion resistance; free machining; lustrous appearance. Available in castings.

35; Al and Mg, and other elements giving special properties. Highest combination (unheat-treated) of ultimate strength, ductility, and impact resistance. Ts, 33,000 to 41,000 psi; elong in 2 in., 7 to 15%; impact str, 6 to 7 ft-lb (Charpy); ys, 15,000 to 21,000 psi; sp gr, 2.62. Free machining; resistant to corrosion. Recommended where heat treat facilities are too costly or unavailable. Available in castings or ingots.

TRITEX NO. 2 (Thermalized manganese steel)—La Salle Steel Co., Hammond, Ind.

C 0.40-0.48, Mn 1.35-1.65, P 0.45 max, S 0.24-0.33, Si 0.10-0.25; furnished in finished bars for machining. Available both cold finished, ground and polished. Induction harden and quench, 1550 F, temper to desired hardness. Free from warpage. For leadscrews and key shafts, or, if heat-treated, gears and shafts.

TRODALOY (Resistance welding electrode)—General Electric Co., Schenectady, N. Y.

No. 1; Co 2.6, Be 0.4, and Cu 97; has 55 per cent conductivity of copper. In heat-treated state: Ts, 90-120,000 psi; impact resistance, high; bhn, 220. For resistance welding electrodes, soldering iron tips, springs, bushings, castings, brake drums, etc. No sales made through General Electric Co. Various Trodaloy items sold through following licensees: P. R. Mallory Co., Ampco Metal Co., Wilbur B. Driver Co., Electroloy Co. and Welding Sales & Engineering Co.

No. 7; generally consists of Be 0.1, Cr 0.4 and Cu 99.5; furnished in rough bars or billets, finished rods or bars, wire, strip, plates for hot forging, stamping, extruding, turning, boring and as sand castings. In heat-treated state: Ts, 45-70,000 psi; impact resistance, high; endurance limit (completely reversed bending), 18-25,000 psi; bhn, 90-140; nonmagnetic. Used for resistance welding electrodes, high conductivity springs and castings, and substitute for P-bronzes.

TRUALOY (Bronze and aluminum alloy castings)—True Alloys Inc., Detroit 9.

Aluminum bronze; Cu 86-89, Fe 2-3, Al 8-10; for sand castings and permanent-mold castings. In untreated state: Ts, 65,000 psi; ys, 28,000 psi; elong in 2 in., 20 per cent; bhn, 135; weldability, good; abrasion resistance, high. For high strength, wearing surfaces under load and low speed.

Aluminum; Cu 3, Si 4, Al balance; for sand and permanent-mold castings. In untreated state; Ts, 26,000 psi; elong in 2 in., 2%; Bhn, 85; weldability, good; resists corrosion caused by salt water; abrasion resistance, medium. For polished castings where high strength, hardness and lightness are required.

Bearing bronze; Sn 8-10, Pb 15, Cu balance; for sand and permanent-mold castings. In cold-worked state: Ts, 25,000 psi; ys, 12,000 psi; elong in 2 in., 8 per cent; weldability, good; abrasion resistance, high. For bearings under load and low pressure.

Manganese bronze; Cu 60, Zn 24, Fe 2, Al 4; for sand and permanent-mold castings. In cold-worked state; Ts, 65,000 psi; ys, 12,000 psi; elong in 2 in., 20 per cent; weldability, good; abrasion resistance, medium. For parts requiring high strength with high elongation.

Also produce castings from all SAE, AISI and ASTM castings specifications.

TRUFLEX (Thermostat metals)—General Plate Div. of Metals and Controls Corp., Attleboro, Mass.

Available in sheets or strips in long lengths, flattened and coiled, or cut to length—spiral, helix or double-helix coils—also fabricated parts, and welded or riveted subassemblies with solid-silver or laminated electrical contacts or mounting brackets. For control or indication of temperature and for compensating movement required in assemblies due to changes in temperature.

TUBE BORIUM (Hard facing rod) — Stoody Company, Whittier, Calif.

A fabricated steel rod containing irregularly shaped particles of cast tungsten carbide in various screen sizes. Hardness is 9-10 on Moh's scale. Deposits are heterogeneous, the tungsten carbide particles being floated in the steel matrix. Used on earth working equipment, drill bits and equipment subjected to severest types of abrasion. For oxy-acetylene and dc electric application.

TUFALOY (Alloy steel castings)—Fort Pitt Steel Castings Div., McKeesport, Pa.

Intermediate manganese or manganese-molybdenum cast steel; ts, 72-165,000 psi; ys, 40-140,000 psi; elong in 2 in., 31-14%; Bhn, 153-302; max cont serv temp, 1100 F. For application where resistance to shock, abrasion and high pressures and temperatures are the principal consideration.

TUF-FLEX (Polished plate glass) — Libbey-Owens-Ford Glass Co., Toledo, O.

Polished plate glass heat tempered, furnished in sheet and laminated form; resists corrosion caused by moisture and all common acids except hydrofluoric acid; heat resistant to 550 F; flexibility, medium; dielectric str, 0.204 kilovolts per mil; modulus of rupture, 30,000 psi; not shatterproof but 4-5 times stronger than plate glass; produced in clear and colors; sp gr, 2.52. For machine guards, observation and inspection windows, sight glasses, gage glasses, etc.

TUF-STUFF -224E (Aluminum-bronze)—Mueller Bros. Co., Port Huron, Mich.

Cu 89, Al 10, Fe 1; furnished in finished rods or bars. Ts, 85-95,000 psi; ys, 55-80,000 psi; elong in 2 in., 12-25%; hardness, Rockwell B, 85-93; is highly resistant to acids and alkalies. Used where high strength and corrosion resistance is required and where excessive hardness is not a factor. For valve seat inserts, valve guides, airplane engine parts, etc.

TUFTEST (Cast iron)—The Medart Co., St. Louis.

For parts subject to excessive abrasion such as guiding disks; machinability, good.

TULOX (Thermoplastic plastics tubing) — Extruded Plastics Inc., Norwalk, Conn.

A; cellulose acetate thermoplastic; furnished in tubing to full range of brilliant colors; transparent, translucent and opaque; odorless and tasteless. More rigid than EC and TT types. Heat resistant to 160 F; ts, 4-6000 psi; sp gr, 12.8.

EC; ethyl cellulose thermoplastic, rigid; furnished in tubes; medium abrasion resistance; high impact strength at low temperature; transparent colors, translucent, opaque, no crystal clear. Tubular parts for use where high impact strength is required over a range of —40 F to 150 F.

TT; cellulose acetate thermoplastic, furnished in extruded tubes in sizes from 0.100-2½ in. OD; abrasion resistance, medium; heat resistant to 160 F; flexibility, low; ts, 4-5000 psi; moisture absorption, low; available in color; sp gr, 1.2; shatterproof; transparent, translucent, opaque; machinibility, good. For use as gage glasses, separators and small machine parts produced on screw machine, etc.

TURBO (Varnished insulating materials)—William Brand & Co., New York 10, N. Y.

Varnished cotton, glass tubing, plastics extruded tubing, varnished cloth, tapes, and mica. Furnished in tubing. Max cont serv temp, 180 F; noninflammable; flexibility, high; dielectric strength (volts per mil) 1000; moisture absorption, low. Conforms to ASTM standards. Used for electrical insulation.

TWINDOW (Insulating glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Prefabricated glass units consisting of two or more pieces of glass enclosing a small hermetically sealed air space. Hollow aluminum tubing separates the pieces of glass. The entrapped air is at atmospheric pressure. Entire edge of each unit is encased in a stainless steel channel. Available in sizes to specification.

TYGOFLEX (Thermoplastic plastics) — U. S. Stoneware Co., Akron 9, O.

Furnished in liquid form for injection and compression molding, casting and extruding. Type 40, as molded, ts, 900 psi; durometer hardness (Shore A) 40 plus or minus 2; sp gr, 1.15; ultimate elongation, 400%; permanent set, 25%; water absorption, 1.5%. Can be used as a coating on metals, ceramics, glass, heat-resistant plastics, as well as for molding and casting into parts.

TYGON (Thermoplastics plastics)—United States Stoneware Co., Akron, O.

Furnished in flexible or rigid sheets, tubing, rods, or in liquid form; may be molded cast or extruded. Abrasion, impact and corrosion-resistant; unaffected by oil, gasoline, water; nonaging; high dielectric and tensile strength. May be transparent, translucent or opaque; available in colors. Nontoxic. For molded machine parts, gaskets, tubing, etc.

TY-LOY (Abrasion-resistant metal)—W. S. Tyler Co., Cleveland.

Special composition metal resistant to abrasive action. Wire screens of this material withstand severe abrasive conditions. Many sizes of square mesh and oblong-opening screens can be made of Ty-Loy.

U

UFORMITE (Plastics resins)—Resinous Products & Chemical Co., Philadelphia 5.

Synthetic resin adhesive, urea-formaldehyde; furnished in powder form; has low moisture absorption, high density. Used in manufacture of waterproof plywood for aircraft and marine use.

U-LOY (Copper bearing steel)—Republic Steel Corp., Cleveland 1.

Has good corrosion resistance, available in hot-rolled and galvanized sheets.

ULTRA-CUT (Bessemer rod)—Bliss & Laughlin Inc., Buffalo, N. Y.; Harvey, Illinois; Mansfield, Mass.

High sulphur bessemer screw stock furnished in cold finished bars. For miscellaneous automatic screw machine parts.

UNISORB (Noise and vibration damping material)—The Felters Co., Boston 11.

A special material for simplifying anchoring of machinery and equipment on all types of floors; absorbs from 60 to 85% of transmitted vibration and noise. Pads grip machine feet on top, floor on bottom; no other anchoring devices necessary. Holding strength, 1500 lbs per square foot, minimum. Petroleum-resistant.

UNITED AMERICAN (Babbitt)—United American Metals Corp., Brooklyn 22, N. Y.

Government genuine babbitt; furnished in bars. In cold-worked state: Ts, 7100 psi; comp str, 18,250 psi; ys, 7700 psi; elong in 2 in., 0.015 per cent; bhn, 28.3. For heavy-duty high-speed engines.

Diesel machine genuine babbitt; furnished in bars. In cold-worked state: Ts, 9760 psi; comp str, 11,740 psi; ys, 7700 psi; elong in 2 in., 0.11 per cent; bhn, 24.8. For diesel type marine engines.

Manganese babbitt; furnished in bars. In cold-worked state: Ts, 11,400 psi; comp str, 19,450 psi; ys, 8000 psi; elong in 2 in., 0.015 per cent; bhn, 21. For general heavy service.

UNIVAN (Nickel-vanadium steel)—Union Steel Casting Division, Blaw Knox Co., Pittsburgh.

Ts, 90,000 psi. For locomotive frames, crossheads, coupling boxes, etc.

UNIVERSAL (Porcelain)—The Universal Clay Products Co., Sandusky, O.

Ceramic-base material for molding into parts. Resists corrosion caused by acids, climatic exposure and fumes, with the exception of hydrofluoric acid; heat resistant to 500 F; moisture absorption, low; available in color; sp gr, 2.3-2.5; opaque. For use in electric insulation.

USALITE 1350 (Ceramic)—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

Furnished in rods and tubes. Max cont serv temp, 2400 F. noninflammable; flexibility, low; ts, 7000 psi; comp str, 30,000 psi;

flexural str, 5000 psi; moisture absorption, medium; available in white; opaque; sp gr, 2.3. For use in pyrometers, etc.

U. S. RUBBER (Natural and synthetic)—U. S. Rubber Co., New York.

For hose, belting, packing, ducts, wire and cable and vibration absorbers. Furnished in sheet, strip, rods or tubes, plate and fluid for molding, stamping, or extruding. Properties to specifications desired.

U. S. S. (Sheet steels)—Carnegie-Illinois Steel Corp., Pittsburgh 30.

Paintbond; galvanized steel sheet for stamping and forming into cases, cabinets, etc.

Galvannealed; galvanized steel sheet for stamping and forming into cases, cabinets, air ducts, dust collectors, etc.

Vitrenamel; sheet for porcelain enameled jackets, casings, trays, cabinets, etc.

Electrical Sheets; also strips, for parts requiring electrical properties. Copper Steel; available in strip, sheet and plate for general sheet metal parts.

Hot-Rolled Sheets and Strips; for sheet metal parts where finished appearance is of secondary importance.

Cold-Rolled Sheet; for sheet metal parts requiring severe forming and where good finish is important.

Also Galvanized sheets and Long Terne sheets.

U. S. S. AMERICAN QUALITY (Carbon and alloy steels)—American Steel & Wire Co., Cleveland.

Carbon steels and alloys in the form of cold rolled strip, manufacturer's wire and springs.

U. S. S. AMERCUT (Carbon and alloy steels)—American Steel & Wire Co., Cleveland.

Cold finished carbon and alloy steel bars either cold drawn, annealed, normalized, spheroidized or quenched and tempered to meet various combinations of definite physical, magnetic, corrosion-resistant or machinability properties specifications.

U. S. S. AR STEEL (Abrasion resisting steel)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

C 0.35-0.5, Mn 1.5-2, P 0.05 max, Si 0.15-0.3, furnished in bars, sheets, strip, plates and shapes; high abrasion resistance; Bhn, approx 200-275 as rolled; heat-treated, 350-450. Used for wear resisting surfaces.

U. S. S. CARILLOY (Standard alloy steels)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

Alloy steels in all standard grades of AISI and SAE steels sold under the above trade name.

U. S. S. COR-TEN (high-strength steel)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; American Steel & Wire Co., Cleveland; and Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

C 0.12 max, Mn 0.3-0.5 max, P 0.07-0.15, Si 0.25-0.75, Cu 0.25-0.55, Ni 0.65 max; furnished in bars, sheets, strip, plates, structural and bar shapes, for hot and cold forming, welding, riveting, etc. Resists atmospheric corrosion four to six times that of plain carbon steel; abrasion resistance, good; ys, 50,000 psi min; ts, 70,000 psi min; good ductility; weldability, good. Used for light-weight construction, where atmospheric corrosion-resistance is a major factor; structural and body members on mobile equipment.

U. S. S. MANG-NI-CU (Steel)—Carnegie-Illinois Steel Corp., Pittsburgh 30.

C 0.25 max, Mn 1.40 max, P 0.045 max, S 0.05 max, Si 0.25 max, Cu 0.30-0.60, Ni 0.50-1.00. Furnished in rough bars or billets, finished rods or bars, strips (coiled), sheets, plates and structural shapes, for hot and cold forming, riveting, etc. Resistance to corrosion 8 times that of plain carbon steel; abrasion resistance, good; ductility, good; weldability, good; ys, 50,000 psi min; ts, 70,000 psi min. Used for lightweight construction where atmospheric corrosion and welding are of major importance.

U. S. S. MAN-TEN (High-strength steel)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

C 0.25 max, Mn 1.1-1.6, P 0.04 max, S 0.05 max, Si 0.3 max, Cu 0.2 min; furnished in bars, sheets, strip, plates, structural and bar shapes for hot and cold forming, welding and riveting. Corrosion-resistant; high abrasion resistance; ys, 50,000 psi min; ts, 75,000 psi, min. Used for lightweight construction where atmospheric corrosion resistance is not a major factor.

U. S. S. PREMIER (Spring steel)—American Steel & Wire Co., Cleveland; Columbia Steel Co., San Francisco; Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

Special processed steel spring wire having high yield and fatigue strength.

U. S. S. SHELBY (Mechanical tubing)—National Tube Co., Pittsburgh.

May be obtained in many different grades from low carbon steel to the stainless grades of alloy steel suitable for various uses in the automotive, aircraft and machine tool industries. Available in sizes up to 10¾ in. OD according to grade and intended use. Made to AISI standards and various industry and government specifications.

U. S. S. STAINLESS (Stainless steels)—American Steel & Wire Co., Cleveland; Carnegie-Illinois Steel Corp., Pittsburgh 30; Columbia Steel Co., San Francisco; National Tube Co., Pittsburgh; Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

Stainless steels in standard forms to AISI Specs. For type, property and characteristics data see "Stainless Steels" listing at end of this section.

"U. S." STANDARD (Chemical stoneware)—United States Stoneware Co., Akron, O.

Acid-proof; available in a wide range of shapes and sizes; resists all corrosives except hydrofluoric acid and hot caustics; for fabrication into tanks, etc., and for lining exhausters and acid-pumps. Hard, durable, available in heat-shock resistant bodies.

UTICA (Aluminum and magnesium castings)—Utica Radiator Corp., Utica 2, N. Y.

Sand castings of various aluminum and magnesium alloys supplied to specification.

V

VALITE (Laminating resin)—Valite Corp., Lockport, La.

No. 8123, laminating resin; thermosetting; for impregnating duck, paper, etc. For housings, silent gears, mountings, switches, etc.

VANADIUM (Alloy steel) — Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

Available in Types D, G, H, K, N and BB, with analyses of C 0.50-1.00, Si 0.25, Mn 0.30, Cr 0.80-1.20 and V 0.20; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rod; for precision casting, machining, hot and cold working, stamping, drawing and brazing. Water or oil-quench, depending upon carbon content, 1425-1550 F; temper 300-1300 F. Hardness, rockwell C, 55-67 max, depending on carbon content. Magnetic; weldability, fair; max cont. serv. temp, 300-500 F. For bearings and high grade machine parts.

VANADIUM PERMENDUR (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A high-density, high-saturation alloy of cobalt, vanadium and iron. Furnished in cold rolled strip, bars and laminations. Has high magnetic saturation. For diaphragms, high density dc cores.

VASCO (Drill rod)—Anchor Drawn Steel Co., Latrobe, Pa.

Oil-hardening drill rods which retain size and shape after hardening and tempering. For dies, punches, small cams and gears, etc.

VECTOLITE (Magnet material)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Nonmetallic, nonconducting magnet material; hardened sintered combination of iron oxide and cobalt oxide mixed when still in powder form. Light in weight and nonconductive properties prevent electrical losses. Have high coercive force or resistance to demagnetizing forces.

VELVETOUCH (Friction materials)—The S. K. Wellman Co., Cleveland.

Bimetallic friction materials consisting of a combination of various powdered metals such as copper, tin, lead and other powdered materials compressed, sintered and welded to a solid metal backing for support. Applications include clutch and brake facings, clutch disks, thrust bearings, etc.

VERTEX (Arc welding electrode) — Metal & Thermit Corp., New York 5.

For general machine part use. Weld deposit: Ts, 62-70,000 psi; ys, 52-60,000 psi; elong in 2 in., 22-30%.

VIBRIN (Plastics resin)—Naugatuck Chemical Div., U. S. Rubber Co., New York.

Polyester thermosetting material; furnished in liquid form, for casting, laminating, impregnating and molding. Available in different grades. Grade 103 has medium abrasion resistance and excellent chemical resistance; flexural strength of 17,000 psi; dielectric str, 2000 volts per mil (0.005-in. sample); ts, 10,000 psi; impact str, 10.3 ft-lb (Izod); from pale yellow to colorless, transparent; moisture absorption, low; sp gr, 1.16. For knobs, covers, etc., and laminated structures of light weight, high strength and decorative appeal.

VICTOLENE (Synthetic rubber)—Victor Mfg. & Gasket Co., Chicago.

Thermosetting material, furnished in sheets and stampings, for molding into parts; resists corrosion caused by oil, gasoline, kerosine, salt water and antifreezers; heat resistant to 250 F; flexibility, high; ts, 350 psi; moisture absorption, medium; inflammable; available in brown; shatterproof; sp gr, 1.12; opaque. For gasketing material, when compressed in position by light metal or plastic stampings, used for sealing fluids.

VICTOPAC (Asbestos-base sheet)—Victor Mfg. & Gasket Co., Chicago.

Compressed sheet packing with asbestos base for stamping or cutting by hand into parts; high corrosion resistance; flexible; ts, 2500 psi; heat-resistant; low moisture absorption; nonflammable; impact-resistant; high compressive strength. Used for gasketing and packing.

VICTOPRENE (Elastic plastics)—Victor Mfg. & Gasket Co., Chicago.

Synthetic elastic, thermosetting; furnished in sheet or molded form. Sheets may be stamped and blanked into parts; corrosion and heat resistant; ts, 1500 psi; low moisture absorption; shatterproof. Used as a gasketing material.

VICTOR (Asbestos sheet)—Victor Mfg. & Gasket Co., Chicago.

Asbestos fiber base; furnished in sheets for stamping or cutting into parts. Corrosion-resistant: flexible; ts, 300 psi; heat resistant to 700 F; nonflammable; sp gr, 0.9; high compressive strength; insoluble; some resilience. Used for packing, thermal insulation, and vibration absorption.

Cork sheet; vegetable bark in sheet form for stamping and cutting into parts. Corrosion-resistant; flexible; heat resistant to 180 F; low moisture absorption; sp gr, 0.27; fair compressive strength; resilient. Used for seals, vibration absorption.

VICTORITE (Fiber-base sheet)—Victor Mfg. & Gasket Co., Chicago.

Vegetable-fiber base sheet packing; furnished for stamping or cutting by hand into machine parts; flexible; ts, 3000 psi; heat resistant to 200 F; nonflammable; impact-resistant; sp gr, 0.675; comp str, 2000 psi; resilient. Use for gasketing and packing.

VICULOY (Beryllium copper) — The Akron Bronze and Aluminum Co., Akron, O.

No. 1; Beryllium copper sand castings, heat-treated at foundry. Ts, 85-90,000 psi; ys, 60-70,000 psi; elong in 2 in., 4-12%; Bhn, 200-220; electrical cond, 50-55; nonmagnetic; weldability, poor; abrasion resistance, medium; corrosion resistance equal to copper. For gears, pinions, flash welding dies, trolley shoes and wheels, boat shafting, welding wheels, marine hardware and fittings.

No. 2; Beryllium copper sand castings heat-treated at foundry, Ts, 45-50,000 psi; ys, 30-35,000 psi; elong in 2 in., 17-22%; Bhn, 120-140; electrical cond, 65-70; nonmagnetic; weldability, poor; abrasion resistance, high; corrosion resistance equal to copper. For circuit breaker parts, current carrying terminals, sliding contacts, burner and current collecting nozzles, spot-welding tips and wheels, etc.

No. 3; Beryllium copper sand castings heat treated at foundry. Ts, 170,000 psi; ys, 120,000 psi; elong in 2 in., 2.8%, Bhn, 370-400; electrical cond, 20-25; nonmagnetic; weldability, poor; abrasion resistance, high; corrosion resistance about same as copper. For gears, rocker arms, die molds, precision bearings and bushings, etc.

VIM (Leather)—E. F. Houghton & Co., Philadelphia 33.

For packings for hydraulically operated mechanisms. Max cont serv temp, 200 F; noninflammable; moisture absorption, low.

VIMLITE (Wire or plastics mesh re-enforced plastics)—Celanese Plastics Corp., New York 16.

Bursting strength (Mullen), wire, 200 psi; plastic 125-165 psi; visible light transmission, wire, 57 per cent, plastic up to 80 per cent; tough, translucent. While both are flexible, plastic mesh handles almost like fabric. Both are lightweight, will not support combustion. For machine guards, etc.

VINYLITE (Thermoplastic vinyl resins)—Bakelite Corp., New York 17.

Thermoplastic vinyl resins; material available as rigid sheets, flexible sheeting, flexible film, rigid and elastomeric molding and extrusion compounds, surface coatings, cloth coatings, textile treatments, adhesives and monofilaments. Can be formed, drawn, laminated, and bonded under moderate heat and pressure. In their basic form, they are odorless, tasteless, nontoxic, and range from nonflammable to slow burning. Some of them have exceptional resistance to moisture and most chemicals. They are strong and tough even at lower-than-freezing temperatures. They do not warp and have unusual dimensional stability.

Vinyl chloride-acetate resins both elastomeric and rigid products in many forms; vinyl acetate resins, adhesives and textile treatments; vinyl butyral resins, safety glass and cloth coatings; vinyl chloride resins, molding and extrusion compounds.

VISKORD (Thermoplastic plastics)—The Visking Corp., Terre Haute, Ind.

Vinylidene chloride type; furnished as monofilament. Abrasion resistance, medium; not affected by weak or strong acids or alkalies or organic solvents; max cont serv temp, 160-200 F; ts, 35,000-45,000 psi; produced in all colors except transparent water white; translucent; sp gr, 1.65-1.75; machinability, good. Used for screen cloth and textile fabrics where chemical resistance and long life are required.

VISQUEEN (Thermoplastic plastics)—The Visking Corp., Terre Haute, Ind.

Polyethylene type; furnished in sheets and tubes; abrasion resistance, medium; not affected by strong or weak acids or alkalies, nor from organic solvents below 50 C; max cont serv temp, 212 F; flexural strength, 1500-1700 psi; ts, 1800-3000 psi; produced in all colors from transparent water white to black; sp gr, 0.93; machinability, good. Used as packaging material, electrical insulation for special uses.

VISTANIX M.M. (Thermoplastic plastics)—Enjay Co. Inc., New York 19.

Polyisobutylene thermoplastic furnished in form of pellets. Has good resistance to ozone, concentrated acids and bases; dielectric strength (volts per mil. inst.), 590; moisture absorption, low; sp gr, 0.93; is translucent; primarily used with other resins and rubbers. Combined with natural rubber or GR-S, it may be used in such products as tire treads, high-voltage electrical insulation, adhesives, steam hose, belt coverings; combines with waxes for paper coatings.

VISTEX (Rubberized laminated felt)—American Felt Co., Glenville, Conn.

Available in Hycar, Neoprene and Buna S types in sheets, strips or cut parts; for stamping and machining. Abrasion resistance, high; chemical resistance, as specified; max cont. serv. temp, 300 F; nonflammable; flexibility, medium; ts, 2000 psi; comp str, 10,000 psi; flexural str, high; elongation, 20 per cent; comp set, 40 per cent; moisture absorption, low; available in grey, brown, black and red; opaque. Self-lubricating positive sealing material. For hydraulic packing washers, gasketing, seals, vibration and shock mounting.

VITALIC (Mechanical rubber)—Continental Rubber Works, Erie, Pa.

Molded, extruded and lathe-cut mechanical rubber products including hose, fan belts, and all types of industrial rubber goods.

VITALLIUM (Cobalt base alloy)—Austenal Laboratories Inc., New York City and Chicago.

Precision-casting, high-strength alloy of Co 65, Cr 30, Mo 5, C 0.20-0.40. Furnished as precision castings to specification. Untreated: Ts, 90-110,000 psi; ys, 52-85,000 psi; elong in 2 in., 5-15%; hardness, Rockwell C, 20-36; nonmagnetic; weldability, good; abrasion resistance, high; resists hot or cold nitric acid; all strengths, hot exhaust gases of leaded fuels, sodium chloride, most organic acids cold dilute hydrochloric and sulphuric acids. Max cont. serv. temp, 1500 F (under load). For parts requiring high strength, corrosion resistance and wear resistance at elevated temperatures.

VITRIC-10 (Ceramic nonplastics)—United States Stoneware Co., Akron, O.

Furnished in powder form for casting into parts or as complete parts; corrosion and heat-resistant (1000 deg F); nonflammable. Available in colors; used for cementing and sealing.

VIX-SYN (Synthetic rubber)—E. F. Houghton & Co., Philadelphia 33.

Synthetic rubber, fabricated and homogeneous, in special molded shapes. Moisture absorption, low; opaque. For packings for hydraulically operated machines.

VOLTRON (Thermoplastic plastics) — Industrial Synthetics Corp., Garwood, N. J.

Polyvinyl chloride base thermoplastic; furnished in strips, rods or tubes; abrasion resistance, high; chemical resistance, high to all inorganic acids and most other chemicals except ketones, esters, aromatic and chlorinated hydrocarbons; max cont serv temp, 158-194 F; self-extinguishing; flexibility, high; dielectric str, 1-2000 volts per mil; ts, 1900-3000 psi (varying with different grades); elongation, 330-435; moisture absorption, low; available in clear, white, black, yellow, red, blue and green; transparent, translucent and opaque; sp gr, 1.19-1.25; shatter-proof. For electrical insulation.

VULCABESTON (Rubber-asbestos base material) —Colt's Mfg. Co., Hartford, Conn.

Crude and synthetic rubber and asbestos base, thermosetting. Furnished in sheet and laminated forms or rods and tubes for machining into parts or supplied as complete parts; heat resistant to 750 F; ts, 7000 psi; dielectric str, 40 volts per mil; corrosion-resistant; low moisture absorption. Uses include insulation, brake linings, packings, gaskets, etc.

VULCOID (Thermoplastic plastics)—Continental-Diamond Fibre Co., Newark 23, Del.

Aniline formaldehyde and cellulose hydrate base thermoplastics; furnished in sheets, rods and tubes for forming into parts. Abrasion resistance, high; max cont. serv. temp, 230 F; flexural str, 23,000 psi (ASTM D-229-42); dielectric str 450 volts per mil; ts, 12,000 psi; comp str 36,000 psi; impact str, 5.0 ft-lb (Izod); available in dark tan; moisture absorption, low; sp gr, 1.1-1.35; opaque; good machinability. For electrical insulation.

VYCOR (Glasses)—Corning Glass Works, Corning, N. Y.

In general, glasses with coefficient of expansion less than $20 \times 10^{-7}/°C$. Blown, drawn, pressed products with wide range of chemical, physical, optical, electrical and mechanical properties.

W

W-30 (Powder metal)—Powdered Metal Products Corp., 9335 W. Belmont Ave., Franklin Park, Ill.

Contains 90% iron powder and 10% copper powder; ts, as pressed and sintered, 34,500 psi; ys, 27,000 psi; imp str (Izod), 2 ft-lb; Rockwell hardness, B 66; abrasion resistance, high; for gears, bushings, pawls, etc.

W-55-a (Powder metal)—Powdered Metal Products Corp., Franklin Park, Ill.

High copper content; furnished in pressed and sintered parts to specification; ts, 21,000 psi; imp str (Izod), 3 ft-lb; Rockwell hardness, H 70; abrasion resistance, medium; for thrust washers, bearings, etc.

WAUKESHA Metals (Copper-nickel alloys) — Waukesha Foundry Co., Waukesha, Wis.

Copper-base, high-nickel content alloys, available in 20 different grades; furnished as sand castings for machining into parts. Ts, up to 105,000 psi; elong in 2 in., from less than 1 to 34 per cent; hardness, brinell (3000 kg), from 93 to 264; resists corrosion caused by dairy, food, beverage and canning products, and salt solutions. For all parts contacting dairy, food, beverage and cannery foods.

WEIRALEAD (Ductile sheets) — Weirton Steel Co., Weirton, W. Va.

Excellent welding characteristics. Its tight, hot-dipped coating serves as a die lubricant and takes deep drawing successfully. It also provides a satisfactory base for paint, lacquer or varnish.

WEIRZIN (Zinc-coated sheets and strip)—Weirton Steel Co., Weirton, W. Va.

Sheets 32½ in. wide (available in coils or cut lengths) down to ⅜-in. strip. Adaptable to a wide variety of uses where the protection of a zinc coated material is required. This material is a high quality ductile steel with bonded coating, for deep drawing.

WELBRONCO (Nonferrous castings)—Wellman Bronze & Aluminum Co., Cleveland.

Copper-base, aluminum and magnesium sand castings to specifications.

WELDRAWN (Welded tubing)—Superior Tube Co., Norristown, Pa.

Cold-drawn to give properties of seamless. Available in certain grades of stainless, beryllium copper, and in nickel and Monel.

WELDWOOD (Resin-bonded plywood)—United States Plywood Corp., New York.

Phenol-formaldehyde and urea-formaldehyde resin-bonded plywood; thermosetting; flexibility varies with thickness; splitproof; shatterproof; high tensile and dielectric strength. Obtainable in waterproof and water-resistant grades in all woods. Also available in molded shapes, tubular and curved.

WELLCAST (Nonferrous castings) — Wellman Bronze & Aluminum Co., Cleveland.

Copper-base, aluminum and magnesium sand castings to specifications.

WEL-MET (Powder metals)—The Wel-Met Co., Kent, O.

Sintered iron; Fe 90, Cu 10; furnished in rough bars and billets, plate, powder metal and in finished parts. Ts, 25,000 psi; comp str, 30,000 psi; bhn, 50; sp gr, 6.0; weldability, good; resists corrosion caused by alkalies; max cont. serv. temp, 300 F as bearing, and 1500 F as machine parts. For self-lubricating bearings and machine parts.

Sintered bronze; Cu 85, Sn 8 and Pb 5; furnished in rough bars or billets, plate, powder metal and in finished bushings or machine parts. Ts, 10,000 psi; comp str, 12,500 psi; elong in 2 in., 5 per cent; bhn, 35; sp gr, 60; nonmagnetic; weldability, good; resists corrosion caused by acids in concentrations normally occurring such as mine water; max cont. serv. temp, as lubricated, 300 F; abrasion resistance, low. For self-lubricating bushings, filters and other applications where controlled porosity is required.

WESTERN (Copper-base alloys)—Western Brass Mills Div. of Olin Industries Inc., East Alton, Ill.

Copper-base alloys (Western Brass, Western Copper, Western Super-X Phosphor Bronze, Western Super-X Nickel Silver); furnished in straight and coiled strip and sheet; for machining, hot and cold working, stamping, drawing, arc, gas and resistance welding, and brazing. Good electrical properties.

WEST FELT (Felt material) — Western Felt Works, Chicago.

Furnished in cut shapes according to user's specifications for vibration dampening, deadening sound, insulating against heat and cold and filtering liquids, air and gases; also as oil or dust seals for bearings.

WILCO (Contact and thermostatic metals)—H. A. Wilson Co., Newark 5, N. J.

Contact materials: silver, tungsten, sintered powder metal, platinum, and alloys. Also thermostatic bimetal, for all temperature ranges, deflection rates and electrical resistivities, and silver-clad steel-jacketed wire, or silver on copper, Invar or other combinations requested.

WILMINGTON FIBRE (Fiber)—Wilmington Fibre Specialty Co., Wilmington, Del.

Cotton rag and paper, chemically treated, nonplastic material; furnished in sheet form or rods and tubes for machining or stamping into parts; dielectric str, 200-400 volts per mil; ts, 12-15,000 psi; resistant to shock and corrosion; high polish; available in colors. Used for electrical and mechanical insulation.

WOLVERINE (Nonferrous tubing) — Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., Detroit.

Aluminum brass; Cu 76, Zn 22, Al 2; furnished in tubing. Corrosion-resistant; medium abrasion-resistant; ts, 52-100,000 psi. For bushings, condenser tubing, etc.

Phosphorized admiralty brass; Cu 70, Zn 29, Sn 1; furnished in tubing. Medium abrasion resistance; ts, 58-90,000 psi. For condenser tubing.

Arsenical Admiralty brass; Cu 70, Zn 29, Sn 1, P 0.015 max, As 0.1 max; furnished in tubing. Corrosion-resistant. For condenser tubing.

70-30 brass; Cu 70, Zn 30; furnished in tubing. Corrosion-resistant; medium abrasion-resistance; ts, 48-88,000 psi. Used for condenser tubing, commercial tubing and pipe.

Red brass; Cu 85, Zn 15; furnished in tubing. Corrosion-resistant; medium abrasion resistance; ts, 40-69,000 psi; high ductility. For condenser tubing.

Common high-brass; Cu 66, Pb 0.80 max, Zn balance; furnished in tubing. Corrosion resistant; medium abrasion resistance; ts, 48-85,000 psi. For cupped, formed or drawn parts, etc.

Copper, oxygen-free; Cu and Ag 99.9 min, P 0.015-0.035 (optional as deoxidizer); furnished in tubing. Corrosion-resistant; ts, 31-60,000 psi; high ductility. For condensers, evaporators, heaters, etc.

Cupro-Nickel; Cu 70, Ni 30; furnished in tubing. Corrosion-resistant; medium abrasion resistance; ts, 65-110,000 psi. For condenser tubing.

Copper, arsenical; Cu and Ag 99.2 min; P 0.015-0.035, As 0.15-0.50; balance is the same as oxygen-free copper.

Commercial bronze; Cu 90, Zn 10; furnished in tubing. Corrosion-resistant; available in color; medium abrasive resistance; ts, 36-63,000 psi; high ductility. For ornamental purposes.

High brass (2 & 1); free turning; Cu 66, Pb 1.75, Zn balance; furnished in tubing. Corrosion-resistant; medium abrasion resistance; ts, 48-85,000 psi; machinability, good. For screw machine parts and fabricated parts.

Muntz metal; Cu 60, Zn 40; furnished in tubing. Corrosion and abrasion resistant; ts, 48-85,000 psi. For condenser tubes, etc.

Aluminum 2S; Al 99; furnished in tubing. Ductility, high; ts, 13-24,000 psi; machinability, poor. Used for airplane parts, oil burners, etc., where light weight is important.

Aluminum 3S; Al 97, Mn 1.25; furnished in tubing. Ductility, good; ts, 16-29,000 psi; machinability, good. Used for airplane parts, oil burners, etc.

WOODEX (Wood)—Neveroil Bearing Co., Wakefield, Mass.

Impregnated rock maple furnished in parts which can be machined; heat resistant to 100 F; inflammable; can be highly polished. For bearing surfaces in textile, road building, agricultural, tobacco and many other types of machinery.

WOODITE (Molded wood)—Syracuse Ornamental Co. Inc., Syracuse, N. Y.

Thermoplastic, furnished as molded parts. Abrasion resistance, low; flexibility, low; opaque. For nameplates, decorative parts.

WORCESTER (Wire)—Worcester Wire Works, Division of National Standard Co., Worcester, Mass.

Steel wire in small diameter sizes, down to 0.006-in., low and high carbon content. Annealed, hard drawn, tempered, bright, lacquer finish, tinned, copper coated, cadmium coated and galvanized.

WORTHITE (Alloy Steel)—Worthington Pump & Machinery Corp., Harrison, N. J.

Ni 24, Cr 20, Mo 3, Si 3.25, C 0.07 max. Cu and Mn 2, Fe, bal; furnished in finished rods or bars and as sand and centrifugal castings for turning, boring, welding, etc. Corrosion-resistant; high resistance to most acid slurries; ts, 97,000 psi, hot rolled, 72,000 psi, sand cast; medium ductility; sp gr, 7.85; bhn, 150-190. Used for pumping equipment, valves, pipe fittings and special apparatus for corrosion resistance.

WYCKOFF (Cold finished steels)—Wyckoff Steel Co., Pittsburgh.

Controlled carbon and alloy steels; turned, polished, ground and polished shafting; annealed, strain and stress relieved, heat-treated, quenched and tempered steels; wide flats up to 12 x 2 in.

WYNENE (Plastics resin)—National Plastic Products Co., Odenton, Md.

Thermoplastic, nontoxic resin. When extruded offers lightness, flexibility, and resistance to moisture and chemicals. Available in neutral translucent, and red, brown, tan, navy, royal blue, yellow, kelly green, nile green, black and white. Suitable for electrical insulation and as a protective coating for wires of all types.

X, Y, Z

X-CREPE (Thermosetting plastics) — Cincinnati Industries, Inc., Cincinnati 15.

Phenol formaldehyde, thermosetting; furnished in rolls, sheets, die cut and coiled; also preforms for compression molding and laminating. Abrasion resistance, medium, resists action of mild acid and alkaline solutions; flexural str, 13,000-15,000 psi (ASTM D 650-42T); dielectric str, 300-400 volts per mil; ts 9200-12,000; comp str, 23,000-38,000 psi; imp str, 1.0-4.5 ft-lb (Izod); available black, brown and dark colors; sp gr 1.45; opaque; machinability, fair. For structural or functional parts where properties of phenolics are desirable.

YOLOY (Nickel steel)—Youngstown Sheet & Tube Co., Youngstown, O.

C 0.05-0.40, Mn 0.3-1.0, Ni 0.75-0.375, Cu 0.40-1.75; special service alloy steel furnished in rough bars or billets, finished rods or bars, tubing, sheets, coiled strip, and plates, for hot forging, stamping, extruding and welding. In untreated state: Ts, 70,000 psi and up, depending on carbon and manganese content; ys, 50,000 psi min; impact resistance, high; weldability, excellent; good machinability.

Z-70 (Powder metal)—Powdered Metal Products Corp., Franklin Park, Ill.

Contains 99% iron powder; furnished in pressed and sintered parts to specification; ts, as pressed and sintered, 70,000 psi; ys, as pressed and sintered, 63,000 psi; imp str (Izod), 3 ft-lb; Rockwell hardness, C 55; abrasion resistance, high; is self lubricating, has high resistance to wear. For ratchets, cams, valves, gears, etc.

ZAMAK (Zinc die casting alloys)—New Jersey Zinc Co., New York.

No. 3; Al 4.1, Mg 0.04, remainder Horse Head Special zinc.

No. 5; Al 4.1, Cu 1.0, Mg 0.04, remainder Horse Head Special zinc.

ZILLOY (Rolled zinc alloy)—The New Jersey Zinc Co., New York.

Contains approximately 1% copper. Furnished in sheets and strips for forming and stamping.

ZINCGRIP (Galvanized sheet iron and steel)—American Rolling Mill Co., Middletown, O.

In strips or coils, with unusual forming and drawing qualities; for use wherever severe forming makes ordinary galvanized sheet metal unsatisfactory. Also supplied with a Paintgrip treatment.

Hot and cold-rolled steels; obtainable in ARMCO ingot iron, copper-bearing steel and varying analyses of medium and low carbon steel. Available in sheet form; for severe forming requirements.

Long ternes; lead-tin, hot-dip coated sheets with ingot iron, mild steel, or high-tensile steel base metal. For deep drawing requirements and paintability.

Spiral-welded pipe, in wall thicknesses of 7/64 to ½ inch, diameters 6 to 36 inches and lengths up to 50 feet; supplied mill coated, galvanized or bituminous coated and lined. Available in standard or custombuilt fittings.

ZIRCITE 1400 (Ceramic)—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

Furnished in rods and tubes. Abrasion resistance, high; chemical resistance, good; max cont serv temp, 2200 F; noninflammable; flexibility, high; dielectric str, 160 volts per mil; ts, 9000 psi; comp str, 80,000 psi; flexural str, 20,000 psi; moisture absorption, low; opaque; shatterproof; sp gr, 0.315. For use where high chemical, heat and impact resistance are required.

ZIRMET (Zirconium metal)—Foote Mineral Co., Inc., Philadelphia 44.

Ductile zirconium metal 99+; furnished in rough bars or billets, finished rods or bars, wire and sheet; for machining, cold working, stamping, drawing and resistance welding. In heat-treated state: Ts, 40,000 psi; sp gr, 6.5; nonmagnetic; machinability, good. For acid-resistant or alkali-resistant parts, also vacuum tube elements.

Z-METAL (Spheroidized pearlitic malleable iron)—Ferrous Metals Corp., New York 18, N. Y.

C 2.0-2.5, Mn. 0.7-0.9, S 0.08, P 0.12-0.15, plus Mo, Cu in some. Furnished as sand castings. Can be hardened in salt bath, and can be flame hardened. In heat-treated state: ts, 75,000-95,000 psi; ys, 50,000-60,000 psi; elong in 2 in., 8-18%; Izod impact, 8-10 ft-lb; Bhn, 170-210; magnetic; weldability, poor; readily brazed; max cont serv temp, 1000 F; abrasion resistance, high. Good machinability. Used for cranks, levers, gears, power link chain, pump parts, etc.

ZORITE (Chromium-nickel alloy) — Michiana Products Corp., Michigan City, Ind.

Ni 35, Cr 15; furnished as sand castings. Ts, 63.500 psi; ys, 36,500 psi; elong. 5%; Bhn, 168; slightly magnetic; weldability, good; heat resistant to 2200 F; abrasion resistance, medium. For furnaces, heaters and electrical resistances.

Standard Stainless Steels

(Classified by AISI types)

Type 301; Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only; ts, 75-270,000 psi; ys, 30-180,000 psi; elong in 2 in., 40-5 per cent. Furnished in rods, bars, billets, wire, sheet, plate, strip and tubing. For parts requiring good corrosion resistance combined with high tensile strength and good ductility.

Type 302; Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only, ts, 85-300,000 psi, ys, 30-280,000 psi, elong in 2 in., 60-5 per cent; fair machinability; excellent cold forming and welding properties. Furnished in sheet, strip, plate, bar, rod, forging billets and tube rounds, tubing, cold drawn shapes and structural shapes. For parts in acid handling, food and dairy equipment. Shafting, bearing plates, heat exchanger tubes, hydraulic tubing, piston rods, plungers, etc.

Type 303; Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only; ts, 85-150,000; ys, 35-135,000; elong in 2 in., 55-10 per cent; good machinability; fair cold forming and welding properties. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For working parts in pumps and valves which must resist corrosion. For screw machine parts requiring strength plus good corrosion resistance.

Type 304; Cr 18, Ni 8 (18-8 type), austenitic, hardenable by cold work only; ts, 85-250,000 psi; ys, 30-225,000 psi; elong in 2 in., 60-5 per cent; slightly better corrosion resistance than Type 302. Furnished in rods, bars, billets, wire, sheet, plate, strip, tubing and castings. For parts in chemical equipment such as shafting, bearing plates, heat exchanger tubes, etc.

Type 308; Cr 20, Ni 10 (20-10 type), austenitic, hardenable by cold work only; ts, 80-130,000 psi; ys, 25-45,000 psi; elong in 2 in., 80-55 per cent. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes and castings. For parts in chemical equipment; shafting, bearing plates, etc. Also welding rods.

Type 309; Cr 25, Ni 12 (25-12 type) austenitic, hardenable by cold work only; ts, 95-190,000 psi; ys, 45-175,000 psi; elong in 2 in., 50-5 per cent; resists scaling to 2000 F, fair machinability, good cold forming properties and excellent weldability. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For parts that must operate continuously at high temperatures. Oil burner parts, furnace parts, heat exchangers, air heaters, baffle plates, etc.

Type 310; Cr 25, Ni 20 (25-20 type), austenitic, hardenable by cold work only; ts annealed), 95-100,000 psi; ys, 40-60,000 psi; elong in 2 in., 55-45 per cent; good welding, drawing and stamping properties; fair machinability. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For parts subject to intermittent heating and cooling. Oil burner parts, heat exchangers, dye house, paper mill and chemical plant equipment.

Type 316; Cr 18, Ni 12, Mo 3, (18-12-3 type) austenitic, hardenable by cold work only; ts, 80-225,000 psi; ys, 35-200,000 psi; elong in 2 in., 55-5 per cent; fair machinability, excellent welding and cold forming properties. Best creep strength at high temp and best corrosion resistance of all grades. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For parts requiring high corrosion resistance and high creep strength at elevated temperatures.

Type 317; Cr 18, Ni 12, Mo 4, (18-12-4 type) austenitic, hardenable by cold work only; ts, 75-100,000; ys, 30-50,000; elong in 2 in., 60-40 per cent (annealed). Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes, castings. For parts for equipment in paper industry; shafts, bearing plates, piston rods, etc.

Type 321; Cr 18, Ni 8, Ti 4 x C min; austenitic, hardenable by cold work only; ts, 80-190,000 psi; ys, 30-175,000 psi; elong in 2 in., 55-5 per cent; fair machinability, excellent welding and cold forming properties. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For welded parts not annealed after welding or which operate at 800-1200 F. Aircraft engine exhaust rings, flanges, etc.

Type 347; Cr 18; Ni 8, Cb 8 x C min; austenitic, hardenable by cold work only; ts, 85-190,000 psi; ys, 35-175,000 psi; elong in 2 in., 50-5 per cent; fair machinability, excellent welding and cold forming properties. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For welded parts not annealed after welding or which operate at 800-1200 F. Aircraft engine exhaust rings, flanges, etc.

Type 403; Cr 12 (straight chromium type) hardenable by heat treatment; ts, 100,000; elong in 2 in., 30 per cent; bhn, 202-241; high impact resistance and elastic limit. Furnished in bar stock and wire. For parts in turbine construction; steam turbine blades.

Type 405; Cr 12, Al 0.1-0.3 (12-Al type) not appreciably hardenable by heat treatment; ts, 60-75,000; ys, 35-50,000; elong in 2 in., 40-24 per cent; is non-air-hardening. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes and castings. For parts requiring welding, annealing boxes, quenching racks, oxidation-resistant partitions.

Type 410; Cr 12 (straight chromium type), hardenable by heat treatment; ts, 75-190,000 psi; ys, 40-150,000 psi; elong in 2 in., 35-15 per cent; good machinability and cold forming properties, good welding properties when annealed. Most popular forging grade of stainless. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. Used where corrosion is not severe, for bolts, nuts, shafting, turbine blading, valve trim and heat treated parts where hardness and toughness are desired.

Type 414; Cr 12, Ni 2, (12-2 type), hardenable by heat treatment; magnetic; ts, 119,000 psi (approx); ys, 94,000 psi (approx); elong in 2 in., 25 per cent (approx); good corrosion resistance. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. Knife blades, tempered rules, straight edges, scraper knives, mild springs, etc. Parts requiring better corrosion resistance and higher strength than Type 410.

Type 416; Cr 12, (straight chromium type with sulphur or selenium added); excellent machinability; ts, 75-185,000 psi; ys, 40-145,000 psi; elong in 2 in., 30-10 per cent; fair cold forming properties; fair corrosion resistance. Furnished in bar, rod, forging billets, wire, cold drawn shapes. For mass production machined parts. Carburetor, instrument and electrical parts. Excellent for screw machine parts.

Type 420 and 420F; Cr 13, C 0.35 (straight chromium type), highly hardenable by heat treatment; ts, 95-250,000 psi; ys, 60-200,000 psi; elong in 2 in., 30-5 per cent; fair machinability and cold forming properties; good corrosion resistance. Type 420F is free machining. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, and structural shapes. Generally used for hard, keen, knife edges for cutlery and surgical instruments.

Type 430; Cr 17 (straight chromium type), nonhardenable by heat treatment; resists scaling to 1500 F; excellent cold heading properties, excellent machinability, does not discolor in atmosphere. Ts, 70-110,000 psi; ys, 40-90,000 psi; elong in 2 in., 35-10 per cent. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For press plates, oil burner parts, screw machine parts, trim for automobiles such as body moldings, hub caps, finishing washers, gas tank caps, etc. Also trim for appliances.

Type 430 F; Cr 17 with 0.07 S or Se; (straight chromium free machining type), nonhardenable by heat treatment; ts, 85-110,000 psi; ys, 55-90,000 psi; elong in 2 in., 27-8 per cent; excellent machinability, fair cold forming properties. Furnished in forging billets, hot-rolled and cold-finished bars, wire and polished shafting. Particularly suitable for parts requiring considerable machining and which need only moderate corrosion resistance. Screw machine parts.

Type 431; Cr 16; Ni 2; (straight chromium type), hardenable by heat treatment; ts, 110-230,000 psi, ys, 85-165,000 psi; elong in 2 in., 20-10 per cent; good machinability; fair cold forming properties; resists scaling to 1500 F. Best corrosion resistance of all hardenable stainless steels. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. For parts requiring excellent physical properties coupled with high corrosion resistance.

Type 440 C and 440 A, B and F; Cr 17, C 1.00 (straight chromium type), hardenable by heat treatment; ts, 105-275,000 psi; ys, 60-225,000 psi; elong in 2 in., 15-2 per cent; fair machinability and cold forming properties. Types A and B are of same analysis except for lower carbon content, thus are less hardenable. Type F is free machining. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. Needle valves, ball check valves, ball bearings, scissors, rules, cutlery, etc.

Type 442; Cr 20, Cu 1; hardenable by cold work only; magnetic; annealed. Approx properties are: Ts, 90,000 psi; ys, 50,000 psi; elong in 2 in., 22 per cent. Resists scaling to 1600 F. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. Scale resistant parts such as in furnaces, soot blower tubes, stirring rods and ladles for molten nonferrous metals.

Type 446; Cr 27 (straight chromium type), nonhardenable by heat treatment; ts, 75-85,000 psi; ys, 45-60,000 psi; elong in 2 in., 35-30 per cent; resists scaling to 2000 F; corrosion resistance equal to 18-8. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. For parts requiring moderate strength when operating at high temperatures. Valves and fittings, baffle plates, heaters, oil burner parts, etc.

Types 501 and 502; Cr 4-6, Type 501 has over 0.10 C; Type 502 has 0.10 C max. Otherwise analyses are identical. Hardenable by heat treatment; magnetic; ts, 60,000 psi min; ys, 25,000 psi min; elong in 2 in., 30 per cent min. Heat and corrosion resistance between that of plain steels and the high chromium and chromium-nickel steels. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. For parts in high temp service; oil refinery and chemical equipment.

Stainless Steels—Trade Names and Producers

ALLEGHENY METALS — Allegheny Ludlum Steel Corp., Brackenridge, Pa.
Types 301, 302, 303A, 303C, 303S, 304, 305, 308, 309, 310, 314, 316, 317, 321, 347, 403, 405, 410, 414, 416, 418, 420, 430, 431, 440A, 440C, 446, 501, 501 plus Mo, 502, 502 plus Mo.

ALMET—Alloy Metal Wire Co. Inc., Prospect Park, Pa.
Types 302, 303, 304, 308, 309, 310, 316, 321, 330, 347, 410, 416, 420, 430, 434, 442, 446.

ARMCO—The American Rolling Mill Co., Middletown, O.
Types 301, 302, 304, 308, 309, 316, 317, 321, 347, 410, 430, 446.

B & W CROLOY—Babcock & Wilcox Tube Co., Beaver Falls, Pa.
Types 302B, 304, 308, 309, 310, 316, 317, 321, 347, 410, 430, 442, 446, 501.

BETHADUR—Bethlehem Steel Co., Bethlehem, Pa.
Types 302, 304, 308, 309, 310, 316, 321, 347, 403, 410, 414, 420, 481, 440A, 440C, 430, 442, 446, 501, 502.

BETHALON—Bethlehem Steel Co., Bethlehem, Pa.
Types 303, 416.

CARPENTER—The Carpenter Steel Co., Reading, Pa.
Types 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 406, 410, 414, 416, 420, 420F, 431, 440A 440B, 440C, 440F, 430, 430F, 442, 443, 446, 501, 502.

ENDURO — Alloy Steel Div., Republic Steel Corp., Massillon, O.
Types 301, 302, 302B, 303, 304, 305, 308, 309, 309S, 310, 316, 317, 321, 347, 403, 410, 414, 416, 420, 420F, 430, 430F, 431, 440, 442, 446, 501, 502.

GLOWELD—Globe Steel Tubes Co., Milwaukee.
Types 304, 316, 347.

INDUSTRIAL — Industrial Steels, Inc., Cambridge 41, Mass.
Types 302, 303, 304, 309, 310, 316, 317, 321, 347, 403, 410, 416, 420, 420F, 440C, 440C-FM, 430, 446.

INGERSOLL—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.
Types 302, 304, 309, 330, 347, 430, 501.

JESSOP—Jessop Steel Co., Washington, Pa.
Types 301, 302, 303, 304, 308, 310, 316, 317, 321, 347, 403, 405, 410, 416, 420, 420F, 440A, 440B, 440C, 440F, 430, 430F, 442, 446, 501, 502.

MISCO METAL—Michigan Steel Casting Co., Detroit 7, Mich.
Types 330, 430, 310, 309.

REZISTAL—Crucible Steel Co. of America, New York.
Types 302, 302B, 303, 304, 308, 309, 310, 316, 317, 321, 347, 403, 410, 414, 416, 420, 431, 440A, 440B, 440C, 440F, 430, 442, 446, 501, 502.

SHARON—Sharon Steel Corp., Sharon, Pa.
Types 301, 302, 302B, 303, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 406, 410, 414, 416, 420, 420F, 431, 440A, 440B, 440C, 440F, 430, 430F, 442, 443, 442, 446, 501, 502.

STERLING—Firth-Sterling Steel Co., McKeesport, Pa.
Types 302, 303, 304, 316, 321, 403, 410, 414, 416, 420, 431, 440A, 440B, 440C, 430, 442.

STERMET—Sterling Alloys Inc., Woburn, Mass.
Types 302, 303, 309, 310, 312, 316, 327, 330, 347.

SUPERIOR—Superior Steel Corp., Carnegie, Pa.
All types.

TIMKEN—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, O.
Types 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, 405, 410, 414 416, 420, 420F, 431, 440A, 440B, 440C, 440F, 430, 430F, 442, 501, 502.

U. S. S. STAINLESS—American Steel & Wire Co., Cleveland.
Types 301, 302, 303, 304, 308, 309, 310, 314, 316, 317, 321, 347, 403, 405, 410, 416, 430, 446, 501, 502.

Index of Materials by Type

OFTEN the engineer responsible for design selects the material for a machine part according to its base and other alloying constituents which are known to influence its properties in a desired direction. To provide the designer with a key between alloying constituents and trade names, the accompanying cross-reference index has been compiled. Data on properties, characteristics and typical applications may be obtained by referring to the alphabetical listing by trade names commencing on Page 181.

Trade-named materials are indexed primarily under the base or predominating alloying element or, in some cases such as bearing metals, under the primary use. Alloying elements which control the properties of the material are arranged alphabetically as subheads under the main heads. In a few cases additional controlling elements are added in italics.

IRON & STEEL

Carbon Steels

- Acipco
- Agaloy
- Ajax
- Aristoloy
- Athenia
- Bethlehem
- Calstrip
- Commonwealth
- Continental
- Cumberland
- Dodge
- Elastuf JJ
- Elastuf Media
- Electrunite
- Esco
- Farrell
- Follansbee
- Globe
- Hylastic
- Inland
- Jalcase
- J & L
- Keystone
- Kidd
- Michigan
- Midvale
- Midvaloy
- Page Wire
- Pittsburgh
- Pompton
- Red Anchor
- Rockrite
- Ryerson
- S. G.
- Sharon
- Speed Case
- Standard
- Strain-Tempered
- Summerill
- Tesco
- Thinsteel
- Timken
- Ti-namel
- Ultra-Cut
- U.S.S. American Quality
- U.S.S. Amercut
- U.S.S. Shelby
- Wyckoff

Chromium Steels

- Accoloy
- Acipco
- Agaloy
- Allegheny metals
- Almet
- Aristoloy
- Armco
- B & W Croloy
- Bethadur
- Bethalon
- Bethlehem
- Buffalo (wire cloth)
- Carpenter
- Circle L
- Cooper alloys
- Duraloy
- EIS 45
- Elastuf (*Ni, Mo*)
- Electrunite
- Enduro
- ES
- Esco
- Genesee
- Globe
- Hotform
- Hylastic
- Industrial
- Ingersoll
- Inland
- Jessop
- Kidd
- Kinite
- Kleenkut
- Lo-cro
- Micro-Rold
- Midvale
- Midvaloy Hi-C Hi-Cr
- Ohmaloy (*Al*)
- Peterson
- Pittsburgh
- Red-Cut Superior (*C*)
- Rezistal
- Rockrite
- Ryerson
- Sealmet
- Sharon
- Stermet
- Summerill
- Superior
- Superior No. 3
- Teton
- Thinsteel
- Timken
- Trentweld
- U.S.S.
- U.S.S. Cor-Ten
- U.S.S. Shelby
- U.S.S. Stainless
- Vanadium
- Weldrawn
- Wyckoff

Chromium-Manganese Steels

- Bethlehem
- Circle L
- Hy-Ten
- Lukens
- Nurex
- Oilway
- PSI

Chromium-Molybdenum Steels

- Amsco
- Atlas No. 93
- B & W Croloy
- Bethlehem
- Circle L
- Continental
- DM (*Si*)
- Elastuf Chro-moly
- Farrell
- Genesee
- Hardtem
- Heppenstall 5 H 50
- Hy-Ten (*Mn*)
- Inland
- Nitralloy (*Al*)
- Pressuredie No. 2
- Pyrasteel
- Sharon
- Shell Die (*Si*)
- Sicromo (*Si*)
- Summerill

Chromium-Molybdenum-Nickel Steels

- Aristoloy
- Bethlehem
- Calite
- Continental
- Cuprodie
- Durodi
- Durimet
- EIS 57
- Elastuff 44
- Finkl
- Haynes Stellite
- Heppenstall 2 C 30
- Hy-Ten
- Lukens
- Tisco
- U.S.S.

Chromium-Nickel Steels

- ABK Metal
- Acipco
- Agaloy
- Allegheny Metal
- Almet
- Aristoloy
- Armco
- B & W Croloy
- Bescoloy
- Bethadur
- Bethalon
- Bethlehem
- Buffalo (wire cloth)
- Calite
- Carpenter
- Chromax
- Chromel
- Cimet
- Circle L
- Continental
- Cooper alloys
- Durco
- Elastuf (*Mo*)
- Electrunite
- Enduro
- ES
- Esco
- Evansteel
- Fahralloy
- Fahrite
- Genesee
- Globe
- Gloweld
- Haynes Stellite (*W*)
- Heppenstall 5 H 50
- Hylastic
- Industrial
- Ingersoll
- Inland
- Jessop
- Kidd
- Lo-Cro
- Lukens
- Mayari R
- Michigan
- Micro-Rold
- Midvale
- Misco
- Na, Na-1, Na-2
- Nichrome
- Ni Hard
- Nikro M
- Ni-Resist
- Par
- Pioneer
- Pittsburgh
- Pyrasteel
- Rezistal
- Ryerson
- Sharon
- Sterling
- Stermet
- Standard
- Superior
- Thermalloy
- Thinsteel
- Timken
- T-Loy
- Trentweld
- U.S.S.
- U.S.S. Cor-Ten
- U.S.S. Shelby
- U.S.S. Stainless
- Weldrawn
- Worthite
- Wyckoff
- Zorite

Chromium-Vanadium-Tungsten Steels

- Bethlehem
- Seminole Hard

Copper Steels

- Beth-cu-loy
- Bethlehem
- National
- U-Loy
- Viculoy

Manganese Steels

- Amsco
- Aristoloy
- Bethlehem
- Carcometal
- Carilloy
- Circle L
- Commonwealth
- Esco
- Genesee
- Inland
- Kidd
- La Sulphite 8640
- Lukens (*V*)
- Max-el
- Michigan
- Moly-Telastic
- Neloy
- Pittsburgh
- Rol-Man
- Ross-Meehan
- Ryerson
- Sharon
- Silver Star
- Speed Case
- Speed Treat
- Stressproof
- Timken
- Tisco
- Tritex No. 2
- Tufaloy
- U.S.S. AR
- U.S.S. Manten
- Wyckoff

Manganese-Molybdenum Steels

- Bethlehem
- Circle L
- Continental
- Deward
- Dodge
- Genesee
- Hy-Ten
- Lukens
- Neloy
- Pitaloy
- Tufaloy

INDEX BY TYPE

Manganese-Nickel Steels

Allegheny Ludlum
Bethlehem
Continental
Resistress
Tisco
U.S.S. Mang-ni-cu

Manganese-Silicon Steels

Aristoloy
Bethlehem
Blue Anchor
Carpenter
Dunkirk EZ
Grade 609
Graph M.N.S. (*Ni*)
N-A-X
Z-Metal

Molybdenum Steels

Aldecor
Aristoloy
Bethlehem
Circle L
Economo
Genesee
Inland
Lukens
U.S.S.

Molybdenum-Nickel Steels

Bethlehem
Circle L
Continental
Republic Double Strength
Tigerloy

Molybdenum-Silicon Steels

Silmo

Nickel Steels

Allegheny Ludlum
Aristoloy
Bethlehem
Carilloy
Carpenter
Commonwealth
Dodge
Inland
Kidd
Lukens
Michigan
Nicloy
Nilbar
Ni-Resist
Pittsburgh
Ryerson
Sharon
Timken
Univan (*C*)
Wyckoff
Yoloy

Silicon Steels

Allegheny Ludlum
Armco
Bethlehem
Durichlor (*Mo*)
Duriron
Graph-Sil
Mosil
Silman (*Mn*)

Other Alloy Steels

Colonial
DM-45
Duc-Ten
Graph-Mo
Graph-Tung
Hylastic
Intra
Marvel
Midvale
Par-Exc
PSF
Python
Rotary
Sharon
Tigerloy
T-Loy
Trantinyl
U.S.S. Premier
U.S.S. Shelby
Worcester Wire

Alloy Cast Irons

Acipco
Afiron
Belectric
Buflokast
Carcoloy
Centralloy
Diamite
Elverite
Gunite
Hitest
Hunt-Spiller Gun Iron
Iralite
Jefaloy
Jewell Alloys
Le Alloy
Sorbo-Mat
Strenes C
Trenite
Tuftest

Malleable Irons

Belectromal
Belmalloy
Duramal
Ermal
Ermalite
Mallix
Perduro
Promal
Shockproof
Supermal
Super Y

Special Steels (not otherwise classified)

Acme Strip
Adamantine
Ammonoduct
Anchor
Aristoloy
Armco
AW
AW Dynalloy
B & W 5202
Beth-co-weld
Bethtelductor
Binney
Colorstrip
Columbia
Comgo
Commercial
Duc-Ten
Dynalloy
Elastuf Chro-Moly
Elastuf Penn
Esco
Farrell
Gold Anchor
Graph-Al
Gunite
Hi-Steel
Jalloy
Kidd
Lektrokast
Lukens
Mo-Max
Naco
National
National Standard
Novo Superior
Otiscoloy
Rayduct
Rex Z Metal
Ruralductor
Smavroc
Steelmesh
Tamco
Timken
Vasco
Wyckoff

Irons

Armco
Byers
Crasfloy
Cromonite
Falls
Frankite
Globeiron
Hiperco (*Co*)
Hipersil
Hytemco
Meehanite
Odis
Old Dominion
Shenango-Penn
Toncan

ALUMINUM BASE

Alclad
Alcoa
Allcast
Bohnalite
Doler Alsiloy No. 1, No. 9 and No. 10
Do-Lite
Kaiser
Permite
Permold
Precision
Red X
Revere
Reynolds
Tenual
Ternalloy
Triple A Almag 35 and 55
Utica
Welbronco
Wellcast

BEARING METALS

Babbitt

Acorn
Adamant
American Marine Genuine
Bearite
Dutch Boy
Glacier
Glyco
Grapho
Hoyt
Johnson
Lumen Alloys
Powder Metal Genuine
National
Stonewall
United American

Other Bearing Metals

Agricola
Anfriloy
Asarcoloy No. 7
Bearium Metals
Bound Brook
Bunting
Commercial
Compo
Defender
Durex
Federal
Formetal
G Alloy
Gramix
Graphalloy
Hy-Speed
Idealoy
Johnson
Ledaloyl
Lubrico
Lubrik
Lumen Alloys
Magnolia
Metaline
Moccasin
Mogul
Monarch
Mueller 600
National
National Metals
Nicuite
Olds Bearing Bronze
Oldsmoloy
Powdiron
Promet
Pyramid
Randall
Ryertex
Sabeco
Sandusky
Satco
Selflube
Sumet

BIMETALS

Chase
Truflex
Wilco

BISMUTH BASE

Cerrobase
Cerrobend
Cerrolow 117
Cerromatrix
Cerrosafe
Cerrotru

BONDED OR PLATED

Alcuplate
American
Apollo
Armco
Bethanized
Bethcolite
Brassoid
Bundyflex
Bundyweld
Chromaloid
Copperweld
Ingaclad
Lukens
Makepeace
Nickeloid
Ni Clad
Platinum Clad
Superior
Suveneer
Thomastrip
Weirzin
Wilco
Zincgrip

COBALT BASE

Alnico (*Al, Ni*)
Delloy Metals
Cunico (*Cu, Ni*)
Haynes Stellite
Vectolite (*Fe*)
Vitallium

COPPER BASE

High Copper

Ampco Metal
Bridgeport
Cupaloy
Eclipse
Hussey
Lektromesh
Mallory
Monarch (*Pb*)
Riverside
Sandusky
Shenango-Penn
Summerill
Trembronze
Wolverine

Copper-Aluminum

Ampcoloy
Ampco Metal
Auromet
Avialite
Frontier
Molin Metal
Resistaloy
Tempaloy (*Ni*)
Trualoy (*Si*)
Tuf Stuff 224 E

Copper-Aluminum-Iron

Ampcoloy
Resistac
Trulaloy
Trualoy

Copper-Beryllium

Beraloy "A"
Berylco
Conduloy
Riverside
Summerill
Weldrawn

Copper-Lead-Zinc

Bridgeport
Chase
Hecla (*Zn*)
Hitensiloy (*Ni*)
Lithlead
Logan
Redaloy
Sandusky
Trualoy
Wolverine

Copper-Nickel

- Adnic
- Advance
- Ambrac
- Ampco Metal
- Anaconda
- Auromet
- Bridgeport
- Chase
- Cunife (*Fe*)
- Cupron
- Cupro-Nickel 30%
- Dairywhite
- Excelsior
- Frontier
- Phosnic
- Riverside (*Zn*)
- Sandusky
- Telnic Bronze
- Ti-Nic-O-Sil
- Waukesha Metals
- Western

Copper-Silicon

- Auromet
- Bridgeport
- Duronze Alloys
- Everdur (*Mn*)
- Herculoy (*Sn or Mn*)
- Olympic

Copper-Tin

- Ampco Metal
- Bearium Metals
- Bridgeport
- Frontier
- Harris 80-10-10
- Sandusky
- Seymour
- Western

Copper-Tin-Zinc

- Admiralty Metal
- Anaconda
- Antimonial Admiralty
- Bridgeport
- Chamet
- Lubrik (*Pb*)
- Oreide
- Roman Bronze
- Sandusky
- Shook (*Pb, Ni*)
- Tobin
- Wolverine

Copper-Zinc

- Aeterna 600
- Ampco Metal
- Anaconda
- Bridgeport
- Cartridge Brass
- D-H-S Bronze
- Hy-Ten-Sl
- Muntz Metal
- Revalon (*Al*)
- Revere (*Pb*)
- Seymour (*Ni*)
- Tombasil
- Western
- Wolverine

Other Copper Alloys

- Ampcoloy
- Buffalo (wire cloth)
- Chase tellurium copper
- Doler Brass
- Elephant Brand
- Elkonite
- Hy-ten-sl
- Mallory
- Moccasin
- Oldsmoloy
- Precision
- Randall
- Sundusky
- Superior
- Welbronco
- Wellcast
- Wolverine

WELDING AND HARD-FACING ELECTRODES, BRAZING COMPOUNDS AND SOLDERS

- Abrasoweld
- Aerisweld
- Agile
- Alternex
- Aluminweld
- Ampco Trode
- Amsco
- APW
- Arcos
- Borod
- Bronzochrom
- Cerroseal
- Cletaloy
- Coast Metal
- Colmonoy
- Cromansil
- Easy-Flo
- Elkonite
- Eutechrom
- Eutectic
- Eutectofilm
- Eutectrod
- Eutectrode
- Ferroweld
- Fillex
- Fleetweld
- Genex
- Handy Flux
- Hardex
- Hardweld
- Hascrome
- Indium
- Manganweld
- Metal & Thermit
- Metco-Weld H
- Molex
- NuBraze
- Oxweld
- Oxycuttend
- Penn
- Phos-Copper
- Shield-Arc
- Sil-Fos
- Silfram
- Softweld
- Stainweld
- Stoodex
- Stoodite
- Stoody
- Stoody Self-Hardening
- Titan
- Toolweld
- Tri-Core
- Trodaloy
- Tube Borium
- Vertex

MAGNESIUM BASE

- Apex
- Doler-Mag
- Dowmetal
- Flylite
- Hills-McCanna
- Lumen Alloys
- M-13
- Mazlo
- Revere
- Superior
- Utica
- Welbronco
- Wellcast

MOLYBDENUM BASE

- Cleve-Tung
- Fansteel
- Mo-lyb-den-um

NICKEL BASE

- Agaloy
- Alray
- Buffalo (wire cloth)
- Chromel 651, 667, Grade A
- Conpernik
- Cooper Alloys
- Durimet
- Hastelloy
- Hipernik
- Illium G
- Inconel
- International Nickel
- Invar
- K-42-B
- Kovar A
- Lektromesh
- Monel
- Nichrome V
- Ni-Span
- Precision
- Shenango Penn
- Summerill
- Tophet
- Trentweld
- Weldrawn

POWDER METALS

- B-50
- Biad
- Carboloy
- Compo
- Crowley
- Durex
- Gempco
- Gramix
- Hardy Powders
- Ledaloyl
- Magicores
- MD
- Moraine
- MRCO
- National
- New Jersey Zinc
- Oilite
- Plast-Iron
- Plast-Manganese
- Plast-Nickel
- Plast-Silicon
- Plast-Sponge
- Plast-Steel
- Powdiron
- Sinteel
- Stackpole
- Velvetouch
- W-30
- W-55-a
- Wel-Met
- Wilco
- Z-70

SILVER BASE

- APW
- Baker
- Elkonite
- Elkonium
- Gibsiloy
- Silmanal (*Mn, Al*)
- Wilco

PLATINUM BASE

- APW
- Baker
- Elkonium
- Ney-Oro-G
- Paliney (*Pb*)
- Wilco

TANTALUM BASE

- Fansteel

TITANIUM BASE

- Ni-Span C (*Cr Ni*)

TUNGSTEN BASE

- Cleve-Tungsten
- Fansteel
- Firthaloy
- Firthite
- Haystellite
- High-Density Alloy 112
- Kennametal
- Mallory
- Talide
- Wilco

ZINC BASE

- Apex
- Doler-Zink
- Illinois
- Precision
- Zamak
- Zilloy

ZIRCONIUM BASE

- Zirmet

PLASTICS, THERMOSETTING

Melamine Formaldehyde

- Consoweld
- Farlite
- Formica
- Melmac
- Micarta
- Resimene
- Textolite

Phenolic

- Amberlite
- Bakelite
- Celoron
- Consoweld
- Co-ro-lite
- Dilecto
- Durez
- Durite
- Farlite
- Formica
- Indur
- Interlake
- Intuc
- Ivoricast
- Kys-ite
- Lamicoid
- Lamitex
- Marblette
- Mecoboard
- Micarta
- Neillite
- Ohmoid
- Plyophen
- Resinox
- Ryertex
- Sko-Resin
- Spauldite
- Synthane
- Taylor Fibre
- Taylor Phenol Fibre
- Tego
- Textolite
- X-Crepe

Polystyrene

- Piccolastic

Urea

- Beetle
- Lamicoid
- Plaskon
- Textolite
- Uformite

Vinyl

- Texrub

Cold Molded

- Garit
- Gummon
- Hemit
- Pyroplax
- Tegit
- Thermoplax

Other Types

- Allymer
- Cardolite
- Dilecto
- Fabroil
- Furetone
- Gemloid
- Glastic
- Haveg 41, 48, 60
- Heresite
- Hiden
- Homalite
- Laminac
- Lamineer
- Marcolite
- MR
- Panelyte
- Permanite
- Phenolite
- Resistal
- Rosite
- Sealon
- Shell-Pli
- Surco American
- Textolite
- Vibrin

PLASTICS, THERMOPLASTIC

Acrylic

- Gemloid

INDEX BY TYPE

Aniline Formaldehyde
Cibanite
Vulcoid

Casein
Ameroid

Cellulose Acetate
Bakelite
Celanese
Chemaco
Durashield
Fibestos
Inceloid
Louverplas
Lumarith
Nixon C/A
Plastacele
Plax
Sandee
Strux
Tenite
Textolite
Tulox

Cellulose Hydrate
Diamond

Cellulose Nitrate
Celluloid
Nitron
Nixon C/N
Pyralin

Ethyl Cellulose
Celcon
Chemaco
Ethocel
Nixon E/C
Plax

Methyl Methacrylate
Lucite
Plastech
Plax
Plexiglas
Textolite

Polyamide
Nylon
Textolite

Polybutene
Bakelite

Polyethylene
Bakelite
Jodapac
Plax
Polythene
Visqueen

Polystyrene
Bakelite
Chemaco
Lustrex
Plax
Polyflex
Styron
Textolite

Polyvinyl Acetal
Saflex

Polyvinyl Alcohol
Compar
Elvanol

Polyvinyl Butyral
Butacite
Vinylite

Styrene
Bakelite
Lustron
Marbon "S"
Plexene
S-Polymer

Vinyl
Clearseal
Elasti-glas
Elastron
Fibron
Gemflex
Sandee
Saran
Synflex
Syntholvar
Texrub
Textolite
Transflex
Tygoflex
Vinylite
Viskord
Voltron

Other Types
Aquaflex
Butacite
Cellulak
Cerex
Cliderite
Complac
Duralon
Elvacet
Forticel
Gemloid
Geon
Hyflex
Inceloid
Irv-o-lite XTE 30
Ivi-flex
Kriston "A"
Lignolite
Lumite
Meadol
Molex
Plastikflex
Pyralin
Resilon
Resistoflex
Resproid
Teflon
Textolite
Thermo-cast
Tygon
Vimlite
Vistanex
Wynene

ADHESIVES

Hydrocal
Hydrostone
Paisley
Penacolite
Pleximent

ASBESTOS

Aztec
Stonewall
Victopac
Victor

BONDING RESINS

Amberlite
BCM
Catabond
Dow Corning DC 2103
Furetone
Interlake
Paisley
Reanite
Resin X
Tego
Uformite
Valite

CARBON & GRAPHITE

Carbocell
Graphicell
Graphitar
International
Karbate
Morganite
National
Ohio
Pure
S.C.P.
Super Graph

CERAMICS

AlSiMag
B & W
Ceraware
Colonial
Cordierite
Crolite
General
Lavite
Pinco
Shamva Mullite
Steatite
Stupakoff
Titanates
Universal
U. S. Standard
Usalite 1350
Vitric 10
Zircite 1400

COMPOSITIONS

Aertite
Armstrong's
Celite
Cel-O-Glass
Cohrlastic
DC 4, 33, 41, 44, 200, 702 and 703
Dufelt
Eel-Slip
Fairprene
Featherweight
Felpro
Feltan
Firecrete
FV
Fyberoid
Gaskofelt
Hy-Temp
Insulkote
Irvington
Irv-o-slot
Irv-o-volt
Maizewood
National
Refrasil
Resistofelt
Revolite
RS
Ruberoid
Turbo
Unisorb
Victorite
Vistex
Vulcabeston

CORKS

Dodge
Victor

FELTS

American
Booth
Felters
"K" Felt
Westfelt

FIBERS

Brandywine
Centraline
Fabroil
Franklin
National
Peerless
Penn
Spaulding Armite
Spauldo
Wilmington Fibre

GLASSES

Aerolite
Blue Ridge
Carrara
Corning
Duolite
Duplate
Fiberglas
Flexseal
Herculite
KGI
LOF
Multiplate
Pennvernon
Pittsburgh
Polaroid
Pyrex
Safetee Sealed Brilliance
Thermopane
Tuf-Flex
Twindow
Vycor

LEATHERS

Graton & Knight
Sirvis

MICA

Micabond
Mycalex

RUBBERS

Acadia
Ace
Ajax
Ameripol
Butaprene
Butyl
Cell-Tite
Chemigum
Conservo
G-E
General
Grakone
Hycar
Koroseal
Lord
Luzerne
Monarch
Neoprene
Orco
Perbunan
Silastic
Silentbloc
Sirvene
Spongex
Tensilastic
Thiokol
U. S. Rubber
Victolene
Victoprene
Vim
Vitalic
Vix-Syn

VARNISHES

Dow Corning DC 996
Harvel
Irvington
Sterling

WOODS

American
Armorply
Benelex 70
Dens-Tech
Densewood
Die-Tech
Farlite Compreg
Fybr-Tech
Haskelite
Jamestown
Lignum-Vitae
Mesh-Tech
Ornametl
Pamudo
Pearl City
Phemaloid
Pluswood
Plymetl
Plymold
Ply-Tech
Preg-Tech
Presdwood
Resnprest
Sweet Home Brand
Syrocowood
Weldwood
Woodex
Woodite

Materials Producers

A

Acme Aluminum Alloys, Inc., 232 N. Findlay St., Dayton 3, O.
Aluminum casting alloys — TRIPLE A ALMAG 35 and TRIPLE A ALMAG 55

Acme Steel Co., 2840 Archer Avenue, Chicago 8, Ill.
Colored strip steel—COLORSTRIP
Strip steel—ACME STRIP

The Advance Foundry Co., 107 Seminary Ave., Dayton, Ohio.
Alloyed high strength cast gray iron — STRENES C

Agaloy Tubing Co., Springfield, O.
Carbon steel, alloy steel, stainless steel, Monel, Inconel, nickel and composite tubing—AGALOY

Ajax Metal Co., 46 Richmond St., Philadelphia 23, Pa.
Copper-base alloys—TOMBASIL

The Akron Bronze & Aluminum Co., Box 1086, Akron 9, O.
Beryllium-copper sand castings—VICULOY

Allegheny Ludlum Steel Corp., Brackenridge, Pa.
Stainless steels—ALLEGHENY METALS
Special alloy tool steels—ATLAS No. 93, PYTHON, SEMINOLE HARD, TETON, DUNKIRK EZ
Nondeforming tool steel—DEWARD
Carbon tool steel—POMPTON
Electrical steels—ALLEGHENY LUDLUM, MONIMAX, VANADIUM, PERMENDUR, MOLYBDENUM PERMALLOY, MU-METAL, OHMALOY and SEALMET. Mild and stainless steel—ALLEGHENY METAL, STAINLESS CLAD
Silicon-Manganese steels—GRADE 609

Alloy Casting Co., Champaign, Ill.
Stainless steel castings—ACCOLOY

Alloy Metal Wire Co., Moore's Station, Prospect Park, Pa.
Stainless steels—ALMET
Electrical resistance alloy wire—ALRAY A, ALRAY C, ALRAY D, EXCELSIOR
Nickel clad copper wire—NI CLAD

Alloys Development Co., Pittsburgh, Pa.
Alloy steels—ALDECOR

Alloy Tungsten Corp., 540—29th Street, Union City, N. J.
High tungsten alloy—HIGH DENSITY ALLOY 112

Alpha Metals, Inc., 363 Hudson Ave., Brooklyn 1, N. Y.
Rosin-filled solder—TRI-CORE

Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh.
Aluminum alloys—ALCOA and ALCLAD

Aluminum Industries Inc., Cincinnati.
Aluminum-base alloy castings—PERMITE

American Agile Corp., 5806 Hough Ave., Cleveland 3, Ohio.
Welding electrodes—AGILE

American Brass Co., Waterbury, Conn.
Copper-aluminum alloy—AVIALITE
Copper-aluminum and nickel alloy—TEMPALOY
High copper alloys — AMBRAC, TOBIN BRONZE, ANACONDA, EVERDUR

American Cast Iron Pipe Co., 2930 N. 16th St., Birmingham, Ala.
Cast irons and steels—ACIPCO

American Crucible Products Co., 1301 Oberlin Ave., Lorain, O.
Bearing bronzes—PROMET

American Cyanamid Co., Plastics Div., 30 Rockefeller Plaza, New York 20.
Urea-formaldehyde plastics—BEETLE
Melamine-formaldehyde plastics—MELMAC
Unsaturated polyester resin—LAMINAC

American Electro Metal Corp., 320 Yonkers Ave., Yonkers 2, N. J.
Steel powder-metal parts—SINTEEL

American Felt Co., Glenville, Conn.
Felt material—"K" FELT and AMERICAN FELT
Rubberized and press laminated felt—VISTEX
Rubberized felt—FELTAN

American Hard Rubber Co., 11 Mercer St., New York.
Hard rubbers—ACE

American Lava Corp., 219 Kruesi Bldg., Chattanooga, Tenn.
Ceramics—AlSiMag

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
Magnesium alloys—MAZLO

American Manganese Bronze Co., Holmesburg, Philadelphia 36, Pa.
Aluminum bronzes—RESISTAC
Aluminum manganese bronzes—HY-TEN-SL

American Manganese Steel Division of American Brake Shoe Co., 389 E. 14th St., Chicago Heights, Ill.
Alloy steel castings—AMSCO Manganese Steel and AMSCO Chromium molybdenum steel.
Welding rods—AMSCO Mang-Co, No. 459, No. 217, Mo-Mang Manganese, Nickel Manganese, Farmface, Ni-Hard, Economy Hardface, Resistwear, No. 1, No. 6, Dieweld, Toolface, Machine Face, and Railface

American Nickeloid Co., 23 Second St., Peru, Ill.
Prefinished bonded-sheet and strip — NICKELOID, CHROMALOID, BRASSOID; AMERICAN Bonded Metals, and Copper Steel

American Plastics Corp., 225 W. 34th St., New York 1.
Casein thermoplastic—AMEROID

American Platinum Works, The, Newark, N. J.
Silver brazing alloys and fluxes, fine, coin and sterling silver, platinum metals and their alloys—APW

American Plywood Corp., New London, Wis.
Phenolic urea plywood—AMERICAN PLYWOOD

American Products Mfg. Co., Oleander and Dublin Sts., New Orleans.
Cellulose derivative thermoplastic — INCELOID

American Rolling Mill Co., Middletown, O.
Stainless and thin gage stainless steel strip—ARMCO
Galvanized sheet iron or steel—ZINCGRIP and PAINTGRIP
Medium silicon electrical steels—TRAN-COR

American Smelting & Refining Co., Equitable Bldg., New York.
Cadmium-nickel bearing alloy — ASARCOLOY No. 7.
Lead-bearing alloy—"G" ALLOY

American Steel & Wire Co., Rockefeller Bldg., Cleveland.
Carbon steels and alloys—U. S. S. AMERICAN QUALITY
Cold-finished steel bars—U. S. S. AMERCUT
High-strength steels—U. S. S. COR-TEN
Stainless steels—U. S. S. STAINLESS
Spring steel—U. S. S. PREMIER

American Steel Foundries, Industrial Div., 410 N. Michigan Ave., Chicago 11.
Cast steels—HYLASTIC

American Wringer Co. Inc., Woonsocket, R. I.
Rubber and rubber synthetics—TENSILASTIC

Ampco Metal Inc., 1745 So. 38th Street, Milwaukee 4.
Corrosion, shock and wear-resistant alloys—AMPCO METAL
Coated welding rods—AMPCO-TRODE
Copper-base alloys—AMPCOLOY

Anchor Drawn Steel Co., Latrobe, Pa.
High-carbon steel drill rod—RED ANCHOR, BLUE ANCHOR, GOLD ANCHOR, ANCHOR Carbon-Vanadium, and VASCO

Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
Aluminum, zinc and magnesium alloys—APEX

Apollo Metal Works, 6605 South Oak Park Ave., Chicago 38.
Prefinished cold-rolled steel—APOLLO

Arcos Corp., Philadelphia 2, Pa.
Arc-welding electrodes—ARCOS
Electric-arc cutting rods—OXYCUTTEND

Armstrong Cork Co., Lancaster, Pa.
Cork compositions, cork-and rubber compositions, synthetic rubber compounds, fiber sheet packings, rag felt papers, and cork-and-synthetic-rubber compositions—ARMSTRONG'S

Athenia Steel Co., Div. of National Standard Co., Clifton, N. J.
High-carbon steels—ATHENIA Steel

Atlas Powder Co., Zapon Div., Stamford, Conn., and N. Chicago, Ill.
Cloth calendered with Bakelite resin—REVOLITE

Aurora Metal Co., 614 West Park Ave., Aurora, Ill.
Aluminum bronze, aluminum nickel bronze, and silicon bronzes—AUROMET

Austenal Laboratories Inc., N. Y. C. and Chicago.
Precision-casting high-strength alloy — VITALLIUM

B

The Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.
Wear resisting cast steels and cast iron—ADAMANTINE, ELVERITE and B & W 5202

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6.
Firebrick—B & W Firebrick

Bakelite Corp., 30 E. 42nd St., New York 17.
Phenolic, urea, cast resin plastics, and polystyrene plastics—BAKELITE

Vinyl chloride-acetate, vinyl acetate and vinyl butyral resins and plastics—VINYLITE

Baker & Co. Inc., 113 Astor St., Newark 5, N. J.
Platinum, palladium, gold, silver and their alloys—BAKER and PLATINUM-CLAD

Bearium Metals Corp., 266 State St., Rochester, N. Y.
Bearing bronzes—BEARIUM METALS

Belle City Malleable Iron Co., Racine, Wis.
Pearlitic malleable iron—BELMALLOY
High-strength malleable iron—BELECTROMAL
Electric-furnace-melted cast iron—BELECTRIC

Beryllium Corp., Reading, Penna.
Beryllium-copper—BERYLCO No. 10, 25, 70, and 165

Bethlehem Steel Co., Bethlehem, Pa.
Butt-welded steel pipe — AMMONODUCT, BETH-CO-WELD and RAYDUCT
Stainless steels—BETHADUR and BETHALON
Zinc-coated steel wire—BETHANIZED
Copper-steel sheets—BETH-CU-LOY
Tin plate—BETHCOLITE
High tensile steel wire—BETHTELDUCTOR
Low alloy, high-strength steel—MAYARI R
Spring steel—SILVER STAR
Steel and steel products—BETHLEHEM

Biad Powder Metallurgy Co., 6635 Kelly St., Pittsburgh 6.
Powder metal parts—BIAD 101, 102, 103, 104, 105, 106, 107, 108 and 109

Binney Castings Co., 2555 Dorr St., Toledo 7, O.
Heat-resisting castings—MIN-OX, BINNEY METAL and BINNEY NO. 71 and NO. 73.

Ernst Bischoff Co. Inc., Plastics Div., Memphis, Tenn.
Thermoplastic tooling materials—THERMO-CAST
Thermoplastic potting materials — CLIDERITE

Bliss & Laughlin Inc., Buffalo, N. Y.; Harvey, Ill.; Mansfield, Mass.
High sulphur bessemer screw stock — ULTRA-CUT
Cold finished steels—STRAIN-TEMPERED

Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit.
Light-aluminum alloy—BOHNALITE

H. Boker & Co., Inc., 101 Duane St., New York 7, N. Y.
Tool steel—INTRA, KINITE
Die steel—OILWAY
High-speed steel—NOVO SUPERIOR

The Bonney Floyd Co., Columbus 7, O.
Steel castings—MM

Booth Felt Co., 444 19th St., Brooklyn, N. Y.
Wool base felt—BOOTH

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.
Bearing bronzes—BOUND BROOK and COMPO
Porous iron bearing alloys—POWDIRON

Braeburn Alloy Steel Corp., Braeburn, Pa.
High abrasion and high tensile strength alloy steels—PRESSUREDIE No. 2 and SUPERIOR No. 3
High speed tool steel—COMGO

Brake Shoe & Casting Div., American Brake Shoe Co., 230 Park Ave., New York.
Ni-Cr alloy steel castings—ABK metal

William Brand & Company, 276 Fourth Ave., New York 10, N. Y.
Varnished insulating material—TURBO

Brandywine Fiber Products Co., 14th and Walnut Sts., Wilmington, Del.
Vulcanized fiber, phenol fiber, paper and canvas-base material—BRANDYWINE

Brighton Electric Steel Casting Co., Beaver Falls, Pa.
Alloy steel castings—BESCOLOY

Bridgeport Brass Co., Bridgeport, Conn.
High-copper silicon bronzes—DURONZE
Copper and zinc alloys—BRIDGEPORT
Tubing—BRIDGEPORT

The Brush Beryllium Co., 3714 Chester Ave., Cleveland 14, Ohio.
Beryllium coppers—CONDULOY and NO. 6

Buchsbaum & Co., S., 1737 So. Michigan, Chicago 16.
Vinylidene chloride and vinyl chloride acetate copolymers—ELASTI-GLAS

Buckeye Brass & Mfg. Co., 6410 Hawthorne, Cleveland.
Bearing bronzes — COMMERCIAL, HY-SPEED and LUBRICO

Buffalo Wire Works Co., Inc., 430 Terrace, Buffalo.
Wire cloth—BUFFALO

Buflovak Equipment Div., Blaw-Knox Co., 1543 Fillmore Ave., Buffalo 11, N. Y.
Alloy cast iron—BUFLOKAST

Bundy Tubing Co., 8100 E. Jefferson, Detroit.
Tubing of steel, Monel, "A" and "L" nickel—BUNDYWELD

Bunting Brass & Bronze Co., Spencer and Carlton Sts., Toledo, O.
Bearing bronzes—BUNTING

Burgess-Parr Co., Freeport, Ill.
Cast nickel alloy—ILLIUM G

Byers Co., A. M., Clark Bldg., Pittsburgh 30.
Wrought iron—BYERS

C

Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh.
Nickel-bronze alloy—NICUITE
Babbitt metals—BEARITE and ACORN

California Cold Rolled Steel Corp., 7140 Anaheim Rd., Los Angeles 22, Calif.
SAE 1010 strip steel—CALSTRIP

Calorizing Co., 400 Hill Ave., Wilkinsburg, Pittsburgh, Pa.
Heat-resisting cast steels—CALITE

Cambridge Wire Cloth Co., Cambridge, Md.
Wire cloth—CAMBRIDGE

Carboloy Co., Inc., 11177 East 8-Mile Rd., Detroit.
Cemented carbides—CARBOLOY

Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh.
Abrasion resisting steels—U.S.S. AR STEEL
Alloy steels—U.S.S. CARILLOY
High strength steels — U.S.S. COR-TEN, U.S.S. MANG-NI-CU steels, U.S.S. MAN-TEN
Stainless steels—U.S.S. STAINLESS
Sheet steels—U.S.S.

Carpenter Steel Co., Reading, Pa.
Stainless and specialty alloy steels—CARPENTER
Low expansion alloys—INVAR

Catalin Corp. of America, 1 Park Ave., New York.
Bonding resin—CATABOND

Celanese Plastics Corp., 180 Madison Ave., New York 16.
Cellulose acetate plastics—LUMARITH
Cellulose nitrate plastics—CELLULOID
Cellulose propionate thermoplastic—FORTICEL
Ethyl-cellulose thermoplastic—CELCON
Wire or plastic-mesh reinforced plastics—VIMLITE
Thermoplastic laminates—CELANESE

Central Paper Co., Inc., 2400 Lakeshore Drive, Muskegon 28, Mich.
Wood-cellulose fiber material — CENTRALINE

Centrifugal Foundry Co., Muskegon, Mich.
Alloy iron castings—CENTRALLOY

Cerro de Pasco Copper Corp., 40 Wall St., New York, N. Y.
Low-melting-point alloys — CERROBASE, CERROBEND, CERROMATRIX, CERROLOW, 117, CERROSAFE, CERROTRU
Metal-to-glass solder—CERROSEAL

Chace Co., W. M., 1616 Beard Ave., Detroit 9.
Thermostatic bimetals, and manganese alloys—CHACE

Chain Belt Co., 1643 W. Bruce St., Milwaukee 4.
High tensile, corrosion-resistant castings—REX Z METAL

Chase Brass & Copper Co., Waterbury 91, Conn.
Corrosion-resistant copper alloys—OLYMPIC BRONZE, ANTIMONIAL, CHAMET BRONZE, CHASE TELLURIUM COPPER, CHASE and PHOSNIC BRONZE.
High tensile strength bronze—TELNIC

Chemaco Corp., Berkeley Heights, N. J.
Cellulose-acetate, ethyl-cellulose, polystyrene molding materials—CHEMACO

Chemical Research Corp., P. O. Box No. 2002, Tulsa 1, Okla.
High-strength plastics—RESISTAL

Chicago Malleable Castings Co., 1225 West 120th St., Chicago 43, Ill.
Alloy malleable castings—SUPER Y

Chicago Rawhide Mfg. Co., 1301 Elston Avenue, Chicago 22, Ill.
Synthetic rubber—SIRVENE
Mechanical leather—SIRVIS

Chicago Steel Foundry Co., Kedzie Ave. and 37th St., Chicago.
High tensile strength castings—EVANSTEEL and PYRASTEEL

Chicopee Mfg. Corp. of Georgia, 40 Worth St., New York, N. Y.
Industrial fabrics—LUMITE

Chrysler Corp. Amplex Div., P. O. Box 2718, Detroit 31.
Bearing bronze—OILITE
Bearing iron alloy—SUPER-OILITE
Bearing iron—IRON OILITE
Bearing iron alloy hardened — SUPER-OILITE "16"
Bearing porous aluminum — ALUMINUM OILITE
Filter elements, porous metal—OILITE FILTERS
Friction materials, porous metal—OILITE FRICTION MATERIALS

Ciba Co. Inc., 627 Greenwich St., New York 14.
Aniline formaldehyde plastics resin — CIBANITE

Cincinnati Industries Inc., 515 Station Ave., Lockland, Cincinnati.
Phenol formaldehyde thermosetting plastic—X-CREPE Resin

Cleveland Laboratories & Mfg. Co. Inc., Holland Ave., Peapack, N. J.
Vinyl resin coatings—CLEARSEAL

Cleveland Tungsten Inc., 10200 Meech Ave., Cleveland.
Copper-tungsten electrodes—CLETALOY
Tungsten ground seal rod — CLEVE-TUNGSTEN
Molybdenum bars, wire, sheet and powder metal—CLEVE-TUNG

Cleveland Twist Drill Co., The, 1242 East 49th St., Cleveland 14, Ohio.
High-speed steel—MO-MAX

The Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y.
Molybdenum alloying element — MO-LYB-DEN-UM

Coast Metals, Inc., Canton, Ohio.
Hard facing alloys—COAST METALS

Cold Metal Products Co., Youngstown, Ohio.
Carbon, alloy and stainless strip steel—THINSTEEL

Colonial Insulator Co., The, 973 Grant St., Akron, O.
Ceramic material—COLONIAL

Colt's Mfg. Co., 17 Van Dyke Ave., Hartford, Conn.
Hard rubber and asbestos base material—VULCABESTON

Columbia Steel & Shafting Co., Woodkirk St., Pittsburgh 30.
High-tensile steel—COLUMBIA

Columbia Steel Co., Russ Bldg., San Francisco 6.
Abrasion-resisting steels—U.S.S. AR STEEL
Alloy steels—U.S.S. CARILLOY
High strength steels — U.S.S. COR-TEN, U.S.S. MAN-TEN
Sheet steels—U.S.S.
Stainless steels—U.S.S. STAINLESS
Spring steel—U.S.S. PREMIER

Columbian Rope Co., Auburn, N. Y.
Phenolic resin base—CO-RO-LITE

Commercial Steel Castings Co., 1205 Cheney Ave., Marion, O.
Steel castings to specification—COMMERCIAL

The Connecticut Hard Rubber Co., 407 East St., New Haven, Conn
Silicone elastomer on fiberglas—COHRLASTIC

Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.
Thermosetting laminated plastics — CONSOWELD

Continental-Diamond Fibre Co., Newark 23, Del.
Phenolic plastics — DILECTO, CELORON, MECOBOARD and DILECTO Glass Fabric
Resinous plastics—VULCOID
Vulcanized fiber—DIAMOND FIBRE
Shellac thermosetting material—CELLUPAK
Mica material—MICABOND

Continental Foundry & Machine Co., East Chicago, Ind.
Iron alloys—CROMONITE and CRASFLOY
Carbon steels and alloy steels for rolls—CONTINENTAL

Continental Rubber Works, 2000 Liberty St., Erie, Pa.
Mechanical rubber—VITALIC

Cooper Alloy Foundry Co., The, Bloy St. & Ramsey Ave., Hillside, N. J.
Metal alloy castings—COOPER ALLOYS

Copperweld Steel Co., Glassport, Pa.
Copper-covered steel—COPPERWELD
S.A.E. alloy and special steels—ARISTOLOY

Corning Glass Works, Corning, N. Y.
Glass materials—CORNING, PYREX and VYCOR

Crowley & Co., Henry L., West Orange, N. J.
Steatite and other ceramics—CROLITE
Powder iron—MAGICORES
Powder metal—CROWLEY

Crucible Steel Casting Co., Almira Ave., and W. 84th St., Cleveland.
Sand castings—PAR

Crucible Steel Co. of America, 405 Lexington Ave., New York.
High-strength alloy steel—MAXEL
Corrosion and heat-resistant alloys—LO CRO and REZISTAL

Cumberland Steel Co., 101 Williams St., Cumberland, Md.
Turned and ground steel—CUMBERLAND

Cutler-Hammer Inc., 12th and St. Paul, Milwaukee.
Bituminous plastic—THERMOPLAX
Asbestos base material—PYROPLAX

D

Joseph Davis Plastics Co., Arlington, N. J.
Thermoplastic plastics—JODA, and JODAPAC

Delloy Metals Corp., Erie Ave. and K St., Philadelphia 24, Pa.
Chromium-cobalt-tungsten alloys—DELLOY METALS

Densewood Corp., The, Elkhorn, Wis.
Impregnated wood—DENSEWOOD

Detroit Gray Iron Foundry, 282 Iron St., Detroit 7, Mich.
Iron alloy casting—LEKTROKAST

Doane Products Corp., The, Meriden, Conn.
Thermoplastic plastics—LOUVERPLAS

Dodge Cork Co. Inc., Manor & Laurel Sts., Lancaster, Pa.
Composition cork—DODGE

Dodge Steel Co., Tacony, Philadelphia 35.
Electric steel castings—DODGE

Doehler-Jervis Corp., 386 Fourth Ave., New York 16, N. Y.
Copper-zinc-silicon die casting alloys — DOLER-BRASS and DOLER-ZINK
Magnesium base die casting alloys — DOLER-MAG
Aluminum base die casting alloys—DOLER-ALUMINUM, DOLER-ALSILOY #1, DOLER-ALSILOY #9, and DOLER-ALSILOY #10

The Dow Chemical Co., Midland, Mich.
Thermoplastic granules — ETHOCEL, STYRON and SARAN
Magnesium and magnesium alloys—DOWMETAL

Dow Corning Corp., Midland, Mich.
Electrical insulating varnish—DOW CORNING DC 996
Silicone rubbers—SILASTIC
Silicone bonding resin—DOW CORNING DC 2103
Silicone greases—DOW CORNING DC 33, DC 41, DC 44
Silicone sealing paste—DOW CORNING DC 4
Silicone fluids—DOW CORNING DC 200, DC 702 and DC 703

Driver Co., Wilbur B., Riverside Ave., Newark, N. J.
Beryllium-copper alloys—BERALOY "A"
Copper-nickel Alloy—CUPRON
Nickel-chromium alloy—TOPHET

Driver-Harris Co., Harrison, N. J.
Heat and electrical resisting alloys—ADVANCE, NIREX, NILVAR, CHROMAX, CIMET, NICHROME and NICHROME V, HYTEMCO

Du Pont de Nemours, E. I., & Co., Inc., Wilmington, Del.
Plastic-coated wire mesh—CEL-O-GLASS
Nitrocellulose base—PYRALIN
Polymethyl-methacrylate base—LUCITE
Cellulose acetate base—PLASTACELE
Polyvinyl alcohol—ELVANOL
Polyvinyl acetate—ELVACET
Polytetrafluoroethylene—TEFLON
Polyvinyl butyral—BUTACITE
Cellular cellulose acetate—STRUX
Laminating resin—BCM
Polyethylene thermoplastic—POLYTHENE

E. I. Du Pont de Nemours & Co. Inc., Fabrics Div., Fairfield, Conn.
Polyamide thermoplastic—NYLON
Synthetic rubber coated fabrics—FAIRPENE

The Duraloy Company, Scottdale, Pa.
Chromium steel—DURALOY

Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.
Phenolic plastics—DUREZ

Durilyte Co. of America, Inc., 1142 South Main St., Kokomo, Ind.
Aluminum-bronze alloys—MOLIN METAL

Duriron Co., Inc., Dayton, O. (and licensees—see Duriron in tradename listing).
Corrosion and heat-resistant alloy castings—DURICHLOR, DURIMET, DURIRON, DURCO and CHLORIMET.

Durite Plastics Inc., 5000 Summerdale Ave., Philadelphia 24, Pa.
Phenol-formaldehyde and phenol-furfural plastics—DURITE

E

Eastern Stainless Steel Corp., Baltimore 3, Md.
Stainless steel sheets—ES

Electric Steel Castings Co., Speedway, Indianapolis, Ind.
Alloy steel castings—DUC-TEN

Electric Steel Foundry Co., 2141 N. W. 25th Ave., Portland 10, Oreg.
Cast steels—ESCO

Electro-Alloys Division, American Brake Shoe Co., Elyria, O.
Ni-Cr alloy steel castings—THERMALLOY

Electro Metallurgical Sales Corp., 30 East 42nd St., New York 17, N. Y.
Ferro alloys and alloying elements—ELECTROMET

Enjay Co. Inc., 15 West 51st St., New York 19.
Nitrile synthetic rubber—PERBUNAN
Isobutylene-isoprene copolymer—BUTYL
Polyisobutylene thermoplastic—VISTANEX
Modified styrene-type thermoplastic resin—S-POLYMER S-50, S-60

Erie Malleable Iron Co., Erie, Pa.
Abrasion and wear-resisting cast irons—ERMAL and ERMALITE

Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.
Welding alloys—BRONZOCHROM, EUTECTIC, EUTECROD, EUTECTRODE, EUTECHROM, EUTECTOFILM

Everhot Products Co., 2001-09 W. Carroll Ave., Chicago 12, Ill.
Copper-fused and copper coated steel tubing—BUNDYFLEX

Extruded Plastics Inc., Norwalk, Conn.
Thermoplastic tubing—TULOX

F

The Fahralloy Co., Harvey, Ill.
High nickel-chrome steel—FAHRALLOY

Falk Corp., The, 3001 W. Canal St., Milwaukee 8, Wis.
Alloy cast steel—MOLY-TELASTIC

Falls Hollow Staybolt Co., 7 E. Portage Trail, Cuyahoga Falls, O.
Wrought iron—FALLS

Fansteel Metallurgical Corp., North Chicago, Ill.
Corrosion-resistant, high-tensile-strength metals—FANSTEEL

Farley & Loetscher Mfg. Co., Dubuque, Iowa.
Phenolic and melamine plastics—FARLITE
Fabric base, thermosetting plastics—FARLITE

Farrell-Cheek Steel Co., Sandusky, O.
Abrasion-resisting cast steels—FARRELL

Federal Mogul Corp., 11031 Shoemaker Ave., Detroit.
Bearing bronzes—FEDERAL BRONZES
Babbitt bearing alloys—MOGUL BABBITTS

The Felters Co., 210 South St., Boston 11, Mass.
Noise and vibration damping material — UNISORB
Felts—FELTERS
Felt laminated with Neoprene—DUFELT

Felt Products Mfg. Co., 1508 Carroll Ave., Chicago 7.
Fiber-rubber-cork-felt material—FELPRO

Ferrous Metals Corp., 36 W. 44th St., New York 18, N. Y.
Abrasion resistant alloy—Z-METAL

Finkl & Sons Co., A., 2011 Southport Ave., Chicago 14.
Alloy steel—DURODI, CUPRODIE, SHELL DIE, and FINKL

Firestone Tire & Rubber Co., Akron, O.
Synthetic rubber—BUTAPRENE

Firth-Sterling Steel Co., McKeesport, Pa.
Sintered carbides—FIRTHITE and FIRTHALOY
Stainless steels, and chrome-nickels—STERLING

The Fitzsimons Steel Co., 1623 Wilson Ave., Youngstown 8, Ohio.
Alloy steels — SPEED CASE, SPEED TREAT

Follansbee Steel Corp., Third and Liberty Aves., Pittsburgh 22, Pa.
Cold rolled strip steel—FOLLANSBEE

Foote Bros. Gear & Machine Corp., 4545 So. Western Blvd., Chicago 9.
Hardened special hard steel—FIVEPOINT DEEPHARD

Foote Mineral Co., Inc., 10 E. Chelten Ave., Philadelphia 44.
Ductile zirconium metal—ZIRMET

Formica Insulation Co., 4614 Spring Grove Ave., Cincinnati 32, O.
Laminated thermosetting plastics—FORMICA

Fort Pitt Steel Casting Div., McKeesport, Pa.
Alloy steel casting—TUFALOY

Frank Foundries Corp., Moline, Ill.
Corrosion and abrasion-resistant iron alloys—FRANKITE

Franklin Fibre-Lamitex Corp., 190 E. 12th St., Wilmington, Del.
Laminated phenolic plastics—LAMITEX
Hard vulcanized fiber—FRANKLIN

Frontier Bronze Corp., 818 Elmwood Ave., Niagara Falls, N. Y.
Heat and wear-resisting alloys—FRONTIER

Furane Plastics & Chemicals Corp., 4500 Brazil St., Los Angeles.
Liquid furfural resin—RESIN X

G

Garfield Mfg. Co., Garfield, N. J.
Thermosetting materials—GAMMON (black); HEMIT (gray-white); TEGIT (phenolic binder) and GARIT

Gatke Corp., 228 No. LaSalle St., Chicago 1.
Asbestos packing—AZTEC

Gemloid Corp., 7900 Albion Ave., Elmhurst, L. I., N. Y.
Tubing and gasketing material—GEMFLEX
Thermoplastic material—GEMLOID
Acrylic thermoplastic—GEMLITE

General Ceramics & Steatite Corp., Keasbey, N. J.
Ceramic materials—CERAWARE, STEATITE, GENERAL CORDIERITE and TITANATES

General Electric Co., Chemical Dept. 1 Plastics Ave., Pittsfield, Mass.
Glass-bonded mica—MYCALEX
Fiber material—FABROIL
Phenolic urea, melamine, cellulose acetate, cellulose acetate butyrate, polystyrene, methyl methacrylate, vinyl chloride acetate, polyamides; thermosetting and thermoplastic plastics—TEXTOLITE
Silicone rubbers—G-E
Permanent magnet alloys—ALNICO, CUNICO and CUNIFE
Magnet materials—SILMANAL and VECTOLITE

General Electric Co., Schenectady, N. Y.
Resistance welding electrode—TRODALOY

General Electric Co., Electronics Dept., Syracuse, N. Y.
Special composite materials — MULTIWEAVE

General Metals Powder Co., Akron, O.
Metallic friction materials—GEMPCO

General Plastics Corp., 119 W. 57th St., New York 19.
Laminated plastics—LAMINEER

General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Thermostat metals—TRUFLEX
Composite aluminum-copper—ALCUPLATE

General Steel Castings Corp., Eddystone, Pa.
Steel castings—COMMONWEALTH

General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind.
Rubber—GENERAL
Composite rubber-metal material—SILENTBLOC

Gibson Electric Co., 8350 Frankstown Ave., Pittsburgh 21.
Powder metal—GIBSILOY

Glacier Metal Co., Richmond, Va.
Bearing babbitt—GLACIER

Globe Steel Tubes Co., Milwaukee.
Seamless steel tubing—GLOBE
High purity ingot iron—GLOBEIRON
Stainless welded tubing—GLOWELD

Goodrich, B. F., Co., Akron, O.
Synthetic rubbers—AMERIPOL and KOROSEAL

Goodrich Chemical Co., B. F., Rose Bldg., Cleveland 15.
Allyl ester, thermosetting material—KRISTON "A"
Polyvinyl chloride thermoplastic—GEON
Synthetic rubber—HYCAR

Goodyear Tire & Rubber Co., Akron, O.
Synthetic rubber—CHEMIGUM

Graphite Metallizing Corp., 1045 Nepperhan Ave., Yonkers 3, N. Y.
Carbon-graphite metallized material — GRAPHALLOY

Graton & Knight Co., 356 Franklin St., Worcester 4, Mass.
Oil resistant rubber—GRAKONE
Mechanical leather—GRATON & KNIGHT Leather

Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit, Mich.
High-strength, low-alloy steels—N-A-X

Gunite Foundries Corp., 302 Peoples Ave., Rockford, Ill.
Processed cast irons, cast steels—GUNITE

H

Handy & Harman, 82 Fulton St., New York 7.
Brazing alloys — SILFOS, EASY-FLO and HANDY FLUX

Hanford Foundry Co., 119 S. Arrowhead Ave., San Bernardino, Calif.
Cast steel—DURITE

Hardy Inc., Charles, 420 Lexington Ave., New York 17.
Powdered metal—HARDY Metal Powders

Harris & Co., Arthur, 212 N. Aberdeen St., Chicago 7.
Copper-nickel alloy—DAIRYWHITE
Bearing metal—HARRIS 80-10-10

Harris Products Co., 5105 Cowan Ave., Cleveland, O.
Rubber-metal composition—HARRIS SILENTBLOC

Harwick Standard Chemical Co., Akron, O.
Polystyrene thermoplastic plastics—PICCOLASTIC

Haskelite Mfg. Corp., Grand Rapids 2, Mich.
Resin-bonded plywoods—HASKELITE, PLYMOLD and PHEMALOID
Wood veneer on steel—ORNAMETL and PLYMETL

Haveg Corp., Newark 23, Del.
Furane thermosetting plastics—HAVEG

Haynes Stellite Co., Kokomo, Ind.
Heat, corrosion and abrasion-resistant cobalt-chromium-tungsten—HAYNES STELLITE
Abrasion-resistant tungsten-carbide diamond substitute—HAYSTELLITE
Impact-resistant, iron-base, hard-facing rod—HASCROME
Nickel-base alloys—HASTELLOY

Heppenstall Co., Hatfield St., Pittsburgh.
Chromium steel—KLEENKUT and EIS 45
Chrome-molybdenum steel—HARDTEM
Chrome-nickel-molybdenum steel—HEPPENSTALL and EIS 57

Heresite & Chemical Co., Manitowoc, Wis.
Phenol-formaldehyde thermosetting plastics—HERESITE

Hewitt Rubber Div., Hewitt-Robins Inc., 240 Kensington Ave., Buffalo 5.
Rubbers—AJAX, CONSERVO, MONARCH

Hills-McCanna Co., 2349 Nelson St., Chicago.
Magnesium and aluminum alloy sand castings—HILLS-McCANNA

Homalite Corp., The, 13 Brookside Drive, Wilmington 166, Del.
Thermosetting plastics—HOMALITE

Hoskins Mfg. Co., 4445 Lawton Ave., Detroit 8.
Nickel base and nickel-chrome steels — CHROMEL
Electrical resistance alloy—COPEL

Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33.
Synthetic rubbers—VIM and VIX-SYN

Howard Foundry Co., Magnesium Div., Chicago.
High strength magnesium alloy—FLYLITE

Hunt-Spiller Mfg. Corp., 383 Dorchester Ave., S., Boston 27.
Cast iron—HUNT-SPILLER Gun Iron

Hussey & Co., C. G., Div. of Copper Range Co., 2850 Second Ave., Pittsburgh.
High copper-base material—HUSSEY

I

Illinois Zinc Co., 2959 W. 47th St., Chicago 32.
Sheet and strip zinc—ILLINOIS

Indium Corp. of America, 1676 Lincoln Ave., Utica, N. Y.
Lead-silver solder—INDIUM

Industrial Steels, Inc., 250 Bent St., Cambridge 42, Mass.
Stainless steels—INDUSTRIAL

Industrial Synthetics Corp., Garwood, N. J.
Rubber-like synthetics—SYNFLEX, ELASTRON and VOLTRON

Ingersoll Steel & Disc Division, Borg-Warner Corp., 310 S. Michigan Ave., Chicago.
Stainless-clad steel—INGACLAD
Stainless steel—INGERSOLL

Inland Steel Co., 38 S. Dearborn St., Chicago 3.
Low-carbon titanium vitreous enameling steel —TI-NAMEL
Low-alloy, high-strength, corrosion-resistant steel—HI-STEEL
Carbon steels, etc.,—INLAND Steels

Insulating Tube Co. Inc., Poughkeepsie, N. Y.
Plastics laminate—INTUC

Interlake Chemical Corp., Union Commerce Bldg., Cleveland 14.
Plastics resins and molding compounds—INTERLAKE

International Graphite & Electrode Corp., St. Marys, Pa.
Graphite electrodes—INTERNATIONAL

International Nickel Co. Inc., 67 Wall St., New York (and licensees).
Corrosion, heat and wear-resisting alloys—NI-TENSYLIRON, NI-HARD, NI-RESIST, NI-SPAN, INTERNATIONAL, NICKEL, MONEL and INCONEL

Irvington Varnish & Insulator Co., Irvington, N. J.
Flexible extruded plastics tubing—HYFLEX, IRV-O-LITE XTE 30, IVI-FLEX and TRANSFLEX, FIBRON NO. 5373, AQUAFLEX
Flexible varnished tubing — IRV-O-VOLT, RS and FV
Insulating paints, enamels—IRVINGTON
Insulating punchings—IRVINGTON
Transformer lead tubing—IRVINGTON
Varnished fabrics and papers—IRVINGTON
Varnished slot insulation—IRV-O-SLOT
Plastic and varnished wire markers—IRVINGTON
Plastic insulating tape and tubing—FIBRON
Lacquered tubing—FV, RS
Insulating varnishes—IRVINGTON and HARVEL
Resins—CARDOLITE and FURETONE

J

Jamestown Veneer & Plywood Corp., Box 581 G, Jamestown, N. Y.
Plywood—JAMESTOWN

Jeffrey Mfg. Co., The, First Ave. and Big Four R. R., Columbus, O. (16)
High-strength malleable irons—PERDURO, and SUPERMAL
Cast irons—JEFALOY

Jelliff Mfg. Corp., C. O., The, Southport, Conn.
One-piece solid metal plated screen—LEKTROMESH

Jessop Steel Co., 540 Green St., Washington, Pa.
Stainless steels—JESSOP

Johns-Manville, 22 E. 40th St., New York 16.
Diatomaceous silica material—CELITE
Rubbery, asphaltic-asbestos material — AERTITE
Asbestos, fiber, graphite and rubber compound—EEL-SLIP
Weatherproof coating—INSULKOTE
Refractory material—FIRECRETE

Johnson Bronze Co., New Castle, Pa.
Bearing metals—JOHNSON, LEDALOYL

Johnson Rubber Co., Middlefield, O.
Rubber—JOHNSON

Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30.
Free-machining steel—JALCASE
High-impact special steel—JALLOY
High-tensile, lightweight steel—OTISCOLOY
Cold-finished steel, cold-drawn shapes and tubing—J & L Steels

K

Keasbey & Mattison Co., Ambler, Pa.
Asbestos materials—HY-TEMP and FEATHERWEIGHT

Kencroft Malleable Co. Inc., 373 Hertel Ave., Buffalo 7.
Ductile white irons—JEWELL Alloys

Kennametal Inc., Latrobe, Pa.
Tungsten-titanium carbide—KENNAMETAL

Keyes Fibre Co., Waterville, Me.
Thermosetting phenol-formaldehyde plastics —KYS-ITE

Keystone Carbon Co., Saint Marys, Pa.
Self-lubricating porous bronze—SELFLUBE

Keystone Drawn Steel Co., Spring City, Pa.
Standard carbon and alloy steels — KEYSTONE

Kidd Drawn Steel Co., West Aliquippa, Pa.
High carbon tool steel—AJAX
SAE grades, special alloys and open hearth and electric furnace tool steels—KIDD

Knight, Maurice A., Co., 175 Kelly Ave., Akron 9, O.
Resinous thermosetting plastics—PERMANITE
Thermosetting copolymer liquid for coating—SEALON

Koppers Co. Inc., Bartlett Hayward Div., Baltimore, Md.
Bronzes—D-H-S

Kopp Glass Inc., Swissvale, Pa.
Industrial glass—KGI

L

The Lake City Malleable Co., 5048 Lakeside Ave., Cleveland 14.
Malleable iron—SHOCKPROOF

Laminated Plastics Inc., 14838 Euclid Ave., Cleveland 12.
Thermosetting polyester—GLASTIC

La Salle Steel Co., Hammond, Ind.
Manganese steels—STRESSPROOF, TRITEX No. 2 (Thermalized) and LA SULPHITE 8640

Lebanon Steel Foundry, Lebanon, Pa.
Stainless steel alloys—CIRCLE L

Lehigh Babbitt Co., Box 1004, Allentown, Pa.
Babbitt metal—GRAPHO

Lehigh Foundries Inc., 1500 Lehigh Drive, Easton, Pa.
Gray iron—LE ALLOY

Lewin-Mathes Co., 1111 Chouteau Ave., St. Louis 2.
Copper and copper alloys and tubing—LMC

Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, O.
Patterned and wire glass—BLUE RIDGE
Polished plate glass—TUF-FLEX and LOF
Glass with metal edge seal—THERMOPANE
Heat-absorbing plate glass LOF

Lignum-Vitae Products Corp., 96-100 Boyd Ave., Jersey City, N. J.
Tropical wood—LIGNUM-VITAE

Lincoln Electric Co., 12818 Coit Rd., Cleveland.
High tensile welding rods—SHIELDARC, MANGANWELD, HARDWELD, ABRASOWELD, TOOLWELD, AERISWELD, FLEETWELD, STAINWELD, FERROWELD, ALUMINWELD and SOFTWELD

Linde Air Products Co., 30 E. 42nd St., New York 17.
Welding rods—OXWELD

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6.
Malleable cast iron—PROMAL

Lithium Co., 111 Sylvan Ave., Newark 4, N. J.
Bronze bearing alloy—LITHLEAD

Lord Mfg. Co., Erie, Pa.
Bonded rubber—LORD

Lukens Steel Co., Coatesville, Pa.
Various types of alloy steels—LUKENS

Lumen Bearing Co., 197 Lathrop St., Buffalo 12.
Bearing alloys—LUMEN ALLOYS

Luzerne Rubber Co., Dewey St., Trenton, N. J.
Hard rubber, thermoplastic—LUZERNE

M

Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh.
Cast iron—IRALITE
High tensile strength metal—MacHEMPITE

Magnolia Metal Co., 18 W. Jersey St., Elizabeth, N. J.
Babbitt metal—ADAMANT Super-Genuine and POWER NICKEL
Antifriction metal—MAGNOLIA, DEFENDER and PYRAMID

Magnus Metal Corp., 80 Jackson Blvd., Chicago. (also 111 Broadway, New York)
Lead base alloy—SATCO

Maizewood Insulation Co., Dubuque, Iowa.
Fiber insulation board—MAIZEWOOD

Makepeace Co., D. E., Attleboro, Mass.
Laminated precious metals—MAKEPEACE

Mallory, P. R., & Co. Inc., Indianapolis.
Welding electrodes—ELKALOY and ELKONITE
Copper base alloys—MALLORY
Electrical contacts—ELKONIUM and ELKONITE

Manganese Steel Forge Co., Allen St. and Butler Ave., Philadelphia.
Alloy forging steel—ROL-MAN

Marathon Chemical Co., Div. of Marathon Paper Mills Co., Rothschild, Wis.
Lignin plastic—LIGNOLITE

The Marblette Corp., 37-21 30th St., Long Island City, N. Y.
Plastics cast phenolic resin—MARBLETTE

Marbon Corp., 1926 W 10th Ave., Gary, Ind.
Modified styrene plastics—MARBON "S"

Marco Chemicals Inc., Sewaren, N. J.
Plastics casting resins—MR
Plastics laminates—MARCOLITE

Masonite Corp., 111 West Washington St., Chicago.
Wood fiber board—PRESDWOOD and BENELEX "70"

Massillon Steel Casting Co., Massillon, O.
Alloy cast steel—TIGERLOY

Mead Corporation, The, Chillicothe, O.
Lignin thermoplastic—MEADOL

Medart Co., 3500 DeKalb St., St. Louis.
High tensile strength cast iron—HITEST
Abrasion-resistant cast iron—TUFTEST
Alloy steel forgings—SMAVROC

Meehanite Metal Corp., Pershing Square Bldg., New Rochelle, N. Y. (and foundries—see Meehanite in tradename listing)
Wear, heat and corrosion-resistant metals—MEEHANITE Metal

Metal & Thermit Corp., 120 Broadway, New York.
Arc welding electrodes—ALTERNEX, CROMANSIL, FILLEX, GENEX, HARDEX, MOLEX, VERTEX and METAL & THERMIT

Metal Carbides Corp., Youngstown, O.
Tungsten carbide metal—TALIDE

Metal Hose Div., Bendix Aviation Corp., Teterboro, N. J.
Seamless flexible metal hose—ECLIPSE and BENDIX

Metallizing Engineering Co. Inc., Long Island City, N. Y.
Powdered hard-facing alloy — METCOWELD H

Metals Disintegrating Co. Inc., Elizabeth B, N. J.
Powder metals—MD Metal Powders

Metals Refining Co., Hammond, Ind.
Powder metal—MRCO

Mica Insulator Co., Schenectady 1, N. Y.
Phenolic and urea-base plastics—LAMCOID

Michiana Products Corp., P. O. Box 302, Michigan City, Ind.
Heat and corrosion resisting castings — ZORITE

Michigan Seamless Tube Co., South Lyon, Mich.
Seamless tubing—MICHIGAN

Michigan Steel Casting Co., 1999 Guoin St., Detroit 7, Mich.
Stainless steel—MISCO METAL

The Midvale Co., Nicetown, Philadelphia 40, Pa.
Heat and corrosion resisting steels—MIDVALE
Cast-to-shape tool steel—MIDVALE Hi-C Hi-CR

The Miller Co., 99 Center St., Meriden, Conn.
Strip bronze—TREMBRONZE

Moccasin Bushing Co., 20th and Chestnut Sts., Chattanooga, Tenn.
Bronze alloys—MOCCASIN

Molex Products Co., 222 West Adams St., Chicago 6, Ill.
Thermoplastic plastics moldings—MOLEX

Molybdenum Corp. of America, Grant Bldg., Pittsburgh.
Alloying elements—MCA Molybdenum and MCA Ferro-Boron

Monarch Alloys Co., Ravenna, O.
High-lead bronzes—MONARCH

Monarch Steel Co., Indianapolis, (also affiliated company, W. J. Holliday & Co., Hammond, Ind.)
Low-carbon, free-machining open-hearth steel—SPEED CASE
Medium-carbon, free-machining open-hearth steel—SPEED TREAT

Monsanto Chemical Co., Plastics Div., Springfield, Mass.
Cellulose nitrate plastics—NITRON
Cellulose acetate—FIBESTOS
Phenolic plastics—RESINOX
Polyvinyl acetal plastics—SAFLEX
Polystyrene, thermoplastics — LUSTRON, LUSTREX
High heat-resistant thermoplastic—CEREX
Melamine plastics—RESIMENE

Moraine Products Div., General Motors Corp., 1420 Wisconsin Blvd., Dayton, O.
Bearing alloys—DUREX
Porous powdered metal—MORAINE

Morganite, Inc., 3302 48th Ave., Long Island City, N. Y.
Carbon-graphite—MORGANITE

Mueller Brass Co., Port Huron, Mich.
Bearing alloy—MUELLER 600
Copper zinc alloy—AETERNA 600
Aluminum brass—TUFF-STUFF 224 E

The Mullite Refractories Co., Canal St., Shelton, Conn.
Ceramic refractory—SHAMVA MULLITE

Mycalex Corp. of America, 60 Clifton Blvd., Clifton, N. J.
Glass-bonded mica—MYCALEX

N

National Alloy Steel Division, Blaw Knox Co., Blaw Knox, Pa.
Heat and corrosion-resisting castings — Na, Na-1, Na-2

National Bearing Div., American Brake Shoe Co., 430 Manchester St., St. Louis 10.
Nonferrous centrifugal and precision castings, etc.—NATIONAL METALS

National Bronze & Aluminum Foundry Co., E. 93rd and Laisy Ave., Cleveland.
Aluminum castings—TENUAL

National Carbon Co. Inc., 30 East 42nd St., New York 17.
Carbon (amorphous) or graphite — NATIONAL
Porous carbon—CARBOCELL
Porous graphite—GRAPHICELL
Impervious carbon or graphite-base material—KARBATE

National Erie Corp., Erie, Pa.
Steel castings—NELOY

National Formetal Co. Inc., 6604 Metta Ave., Cleveland 14.
Bushings and bearings—FORMETAL

National Lead Co., 111 Broadway, New York 6.
Babbitt metal—DUTCH BOY and HOYT

National Malleable & Steel Castings Co., 10600 Quincy Ave., Cleveland.
Alloy cast steel—NACO
Malleable cast iron—MALLIX
Chromium-manganese-carbon alloy—NUREX
High-strength steel—NATIONAL Graphitic Steel

National Molded Products Inc., 122 Mill St., St. Marys, Pa.
Powder metal—NATIONAL

National Plastic Products Co., Odenton, Md.
Nontoxic resin—WYNENE

The National Smelting Co., 6700 Grand Ave., Cleveland 5, Ohio.
Aluminum casting alloys—ALLCAST, TERNALLOY, and RED X

National Standard Co., Niles, Mich.
Wires, braided wire and tapes—NATIONAL-STANDARD

The National Supply Co., Torrance, Calif.
Carbon and alloy steels—IDEAL ELECTRIC STEEL

National Tube Co., Frick Bldg., Pittsburgh 19.
Tubing, mechanical—U.S.S. SHELBY
Tubes, stainless steel—U.S.S. STAINLESS

National Vulcanized Fibre Co., Wilmington, Del.
Laminated Plastics—PHENOLITE
Cotton-cellulose base, vulcanized fiber—NATIONAL FIBRE, NATIONAL SWITCH INSULATION
Cotton-rag base, fish-paper insulation — PEERLESS

Naugatuck Chemical Div., U. S. Rubber Co., 1236 Sixth Ave., New York.
Polyester thermosetting material — VIBRIN Resins

Neveroil Bearing Co., Wakefield, Mass.
Impregnated maple bearings—WOODEX

The New Jersey Zinc Co., 160 Front St., New York 7, N. Y.
Zinc die casting alloys—ZAMAK
Rolled zinc alloys—ZILLOY
Brass, bronze, copper and zinc powders—NEW JERSEY ZINC

Ney Co., The J. M., 71 Elm St., Hartford, Conn.
Corrosion-resistant alloys — PALINEY and NEY-ORO G

Nitralloy Corp., 230 Park Avenue, New York.
(licensees—see Nitralloy in tradename listing.)
Nitriding steel—NITRALLOY

Nixon Nitration Works, Nixon, N. J.
Cellulose acetates—NIXON C/A
Cellulose nitrate—NIXON C/N
Ethyl cellulose—NIXON E/C

O

Ohio Carbon Co, 12508 Berea Rd., Cleveland 11.
Carbon and carbon graphite—OHIO Carbon

Ohio Ferro Alloys Corp., Canton, O.
Ferro alloys—PHILO and RANIER

Ohio Rubber Co., Willoughby, O.
Natural and synthetic rubbers—ORCO

Ohio Seamless Tube Co., Shelby, O.
Precision tubing—OSTUCO

Ohio Steel Foundry Co., The, Springfield, Ohio.
Heat and corrosion resistant steel castings—FAHRITE

Old Dominion Iron & Steel Corp., Belle Isle, Richmond 3, Va.
Staybolt wrought iron—ODIS and OLD DOMINION Iron

Olds Alloys Co., 4481 Mason St., Southgate, Calif.
Cr-Ni-Mo bronze—OLDSMOLOY
High leaded nickel bronze—OLDS BEARING BRONZE

Oregon Plywood Co., Sweet Home, Oregon.
Resin-bonded plywood — SWEET HOME BRAND

Owens-Corning Fiberglas Corp., Toledo, O.
Glass, in fiber form—FIBERGLAS

P

Pacific Car & Foundry Co., Renton, Wash.
Alloy iron castings—CARCOLOY
Alloy steel castings—CARCOMETAL

Pacific Mutual Door Co., Plywood Div., Tacoma 1, Wash.
Plywood—PAMUDO

Page Steel & Wire Div., American Chain & Cable Co. Inc., Monessen, Pa.
Low and high carbon steel wire—PAGE

Egyptian bronze relics date back to about 1500 B. C.

Ancient French bronze vase, probably over 2000 years old.

Old Bronze Anchor

recently dredged up from Monterey Bay, California, where it had lain in salt water for over 300 years.

Bronze

The Eternal Metal

Ancient civilization's artisans planned better than they knew . . . when they used BRONZE to fashion implements of war and living. Today you can see numerous examples of their art . . . untouched by the ravages of time and the elements after 3000 years. This . . . because bronze has such excellent *corrosion resistant* properties.

Today, more and more manufacturers are turning to bronze for their bearings. They find that, when the proper alloy is selected, they do not have to worry about the effects of industrial atmospheric conditions . . . water, salt or fresh . . . or other corrosive factors. They gain other important qualities, too, such as low cost . . . quiet operation . . . long bearing life . . resistance to shock and impact . . . low coefficient of friction . . . etc.

The easiest way to determine which bearing will best suit each application is to ask *Johnson Bronze*. For more than forty years we have been helping manufacturers get more bearing service for less money. We are ready to help you NOW.

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525 S. MILL ST. • NEW CASTLE, PA.

Johnson Bronze Sleeve Bearings Give You Every Worthwhile Advantage

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- PRECISION
- QUIET
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- CORROSION RESISTANT
- UNIT CONSTRUCTION
- LOAD CARRYING CAPACITY
- HIGH RESISTANCE TO SHOCK
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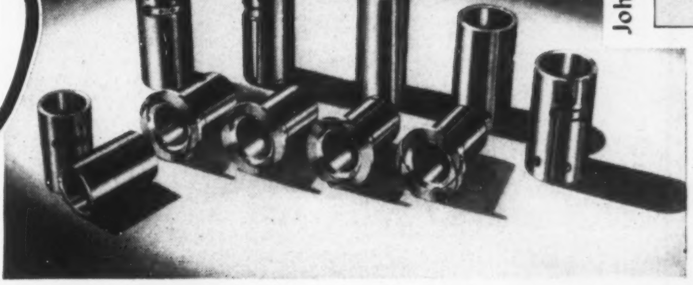
- EASY TO INSTALL
- CONFORMABILITY
- NATION WIDE SERVICE

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
BRANCHES IN 18 INDUSTRIAL CENTERS



Johnson Bronze Sleeve Bearings as used in outboard motors.

Paisley Products Inc., 1770 Canalport Ave., Chicago 16, Ill.
Adhesives—PAISLEY

Panelyte Div., St. Regis Paper Co., 230 Park Ave., New York.
Laminated plastics, thermosetting — PANELYTE

Parkwood Corp., 24 Water St., Wakefield, Mass.
Laminated plastics—HIDEN

Pearl City Plywood Co. Inc., Allen St. Ext., Jamestown, N. Y.
Plywood and veneer—PEARL CITY Plywood

Penacolite Div., Pennsylvania Coal Products Co., Petrolia, Pa.
Resorcin resin adhesive — PENACOLITE G-1131

Penn Brass & Copper Co., Erie, Pa.
Seamless brass and copper tubing — SUPERIOR

Penn Fibre & Specialty Co., 2030 E. Westmoreland St., Philadelphia 34.
Paper base material—PENN Fibres

Penn Metal Co. Inc., 40 Central St., Boston 9, Mass.
Expanded steel sheet—STEELMESH

Permanente Metals Corp., The, Kaiser Bldg., 1924 Broadway, Oakland 12, Calif.
Aluminum alloys—KAISER ALUMINUM

Permold Co., Medina, O.
Permanent-mold and sand castings (aluminum)—PERMOLD

Peterson Steel—Peterson Steels Inc., 420 Lexington Ave., New York 17.
High abrasion resistance steels—PETERSON STEELS and PSI

Phosphor Bronze Smelting Co., 2200 Washington Ave., Philadelphia 46.
Phosphor bronze—ELEPHANT BRAND

Pioneer Alloy Products Co., 16601 Euclid Ave., Cleveland 12, Ohio.
Nickel-chromium alloy steel castings — PIONEER

Pittsburgh Brass Mfg. Co., 3155 Penn Ave., Pittsburgh 1.
Bearing bronze—LUBRIK

Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19.
Heat-treated plate glass — HERCULITE, PENN-VERNON, CARRARA and PITTSBURGH PLATE
Laminated plate glass—DUPLATE, DUOLITE, AEROLITE, MULTIPLATE and FLEXSEAL
Allyl resin monomers—ALLYMER
Insulating glass—TWINDOW

Pittsburgh Steel Co., Grant Bldg., Pittsburgh 30.
Carbon and alloy steels—PITTSBURGH

Pittsburgh Steel Foundry Corp., Glassport, Pa.
Manganese-molybdenum alloy — PITALOY and PSF

Plaskon Division, Libbey-Owens-Ford Glass Co., 2112 Sylvan Ave., Toledo, O.
Thermosetting plastics—PLASKON

Plastic Fabricators Inc., 440 Sansome St., San Francisco 11.
Cellulose acetate thermoplastic — DURASHIELD

Plastic Metals Div., The National Radiator Co., 177 Bridge St., Johnstown, Pa.
Powder metals — PLAST-IRON, PLAST-MANGANESE, PLAST-SILICON, PLAST-SPONGE, PLAST-NICKEL and PLAST-STEEL

Plastic Parts & Sales, 1157 S. Kingshighway, St. Louis 10, Mo.
Plastics cement—PLEXIMENT

Plax Corp., 133 Walnut St., Hartford 1, Conn.
Thermoplastic materials—PLAX and POLYFLEX

Pluswood Inc., Oshkosh, Wis.
Resin-impregnated plywood—PLUSWOOD

Plylock Corp., subsidiary of M & M Wood Working Co., Portland, Ore.
Phenol-formaldehyde bonded exterior plywood—RESNPREST

Poinsettia Co. Inc., Pitman, N. J.
Shellac-base plastics—COMPLAC

Polaroid Corp., Cambridge, Mass.
Light-polarizing glass—POLAROID

The Porcelain Insulator Corp., Lima, N. Y.
Ceramic base material—PINCO Porcelain

Potts Co., Horace T., E. Erie Ave., and D St., Philadelphia 34.
Chrome-nickel-molybdenum alloy — ELASTUF "44"
Cold-finished and hot-rolled steels—ELASTUF PENN
Hot-rolled and precision finish machinery steels—ELASTUF MEDIA
Alloy machinery steels—ELASTUF TYPE A-2
Chromium-molybdenum steels — ELASTUF CHRO-MOLY

Powdered Metal Products Corp., 9335 W. Belmont Ave., Franklin Park, Ill.
Powdered metal parts—Z-70, W-30, W-55-a and B-50

Precision Castings Co., Inc., Syracuse, New York.
Aluminum and zinc base alloys—PRECISION
Magnesium die castings—M-13

Precision Tube Co., 3824 Terrace St., Philadelphia.
Seamless tubing, and metal-shielded wire—PRECISION

Price Associates, M. B., 350 Fifth Ave., New York.
Rubber-like, vinyl base plastic—TEXRUB

Pure Carbon Co. Inc., 441 Hall Ave., St. Marys, Pa.
Pure carbon—PURE CARBON

R

Randall Graphite Products Corp., 609 W. Lake St., Chicago.
Graphite bronze bearings and bushings—RANDALL

Reichold Chemicals Inc., 601 Woodward Heights Blvd., Detroit 20.
Thermosetting material—PLYOPHEN

Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis.
Phenolic plastics — INDUR and INDUR VARNISH

Reliance Steel Casting Co., 2818 Smallman St., Pittsburgh, Pa.
Alloy steel castings—RESISTRESS

Republic Steel Corp., Republic Bldg., Cleveland.
Open-hearth iron alloy—TONCAN
Copper-bearing steel—U-LOY
High-strength steel—COR-TEN (See under U.S.S. COR-TEN) and ALDECOR
High strength steel — REPUBLC Double Strength

Republic Steel Corp., Alloy Steel Div., Massillon, O.
Stainless and heat-resisting alloys—ENDURO

Resinous Products & Chemical Co., 222 West Washington Sq., Philadelphia 5.
Plywood adhesive resins — AMBERLITE, TEGO and UFORMITE
Polyester resins in styrene—PARAPIEX

Resistoflex Corp., Belleville, N. J.
Synthetic resin-base plastics — RESISTOFLEX
Compounded, modified polyvinyl-alcohol base —COMPAR

Respro Inc., Wellington Ave., Cranston 10, R. I.
Thermoplastic plastics—RESPROID

Revere Copper & Brass Inc., 230 Park Ave., New York 17.
Nonmagnetic corrosion-resistant, silicon bronze —HERCULOY
Bearing bronze—ROMAN BRONZE
Condenser tubes and plates—REVALON and CUPRO-NICKEL, 30 per cent
Magnesium and aluminum alloys—REVERE
Free-cutting brass—REVERE
High corrosion-resistant brass — MUNTZ Metal
High tensile strength brasses—CARTRIDGE Brass and ADMIRALTY Metal

Reynolds Metals Co. Inc., P. O. Box 1800, Louisville 1, Ky.
Wrought aluminum alloys—REYNOLDS

Rhoades, R. W., Metaline Co. Inc., P. O. Box No. 11, Long Island City, N. Y.
Heat-resisting bearing bronze—METALINE

Richardson Co., The, Melrose Park, Ill.
Thermosetting, thermoplastic and translucent plastics—INSUROK
Acid-resisting bituminous plastics—EBROK
Hard rubber—RUBEROK

Rigid-Tex Corp., 658 Ohio, Buffalo 3, N. Y.
Sheet or strip metals—RIGIDIZED Metal

Riverside Metal Co., Riverside, N. J.
Phosphor bronze, nickel silver and beryllium copper—RIVERSIDE

Rohm & Haas Co., Washington Square, Philadelphia 5.
Acrylic base plastics—PLEXIGLAS
Modified styrene base plastics—PLEXENE

Ross-Meehan Foundries, 1601 Carter St., Chattanooga, Tenn.
Manganese cast steels—ROSS-MEEHAN

Rostone Corp., Lafayette, Ind.
Inorganic plastics—ROSITE

Rotary Electric Steel Co., Box 90, Ferndale Sta., Detroit.
Standard SAE grades of alloy steels—ROTARY

Ruberoid Co., 500 Fifth Ave., New York 18.
Asbestos cement board—STONEWALL
Insulating tape—RUBEROID

Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago.
Specially processed lead base alloys — GLYCO
Standard steels—RYERSON
Bearing material—RYERTEX

S

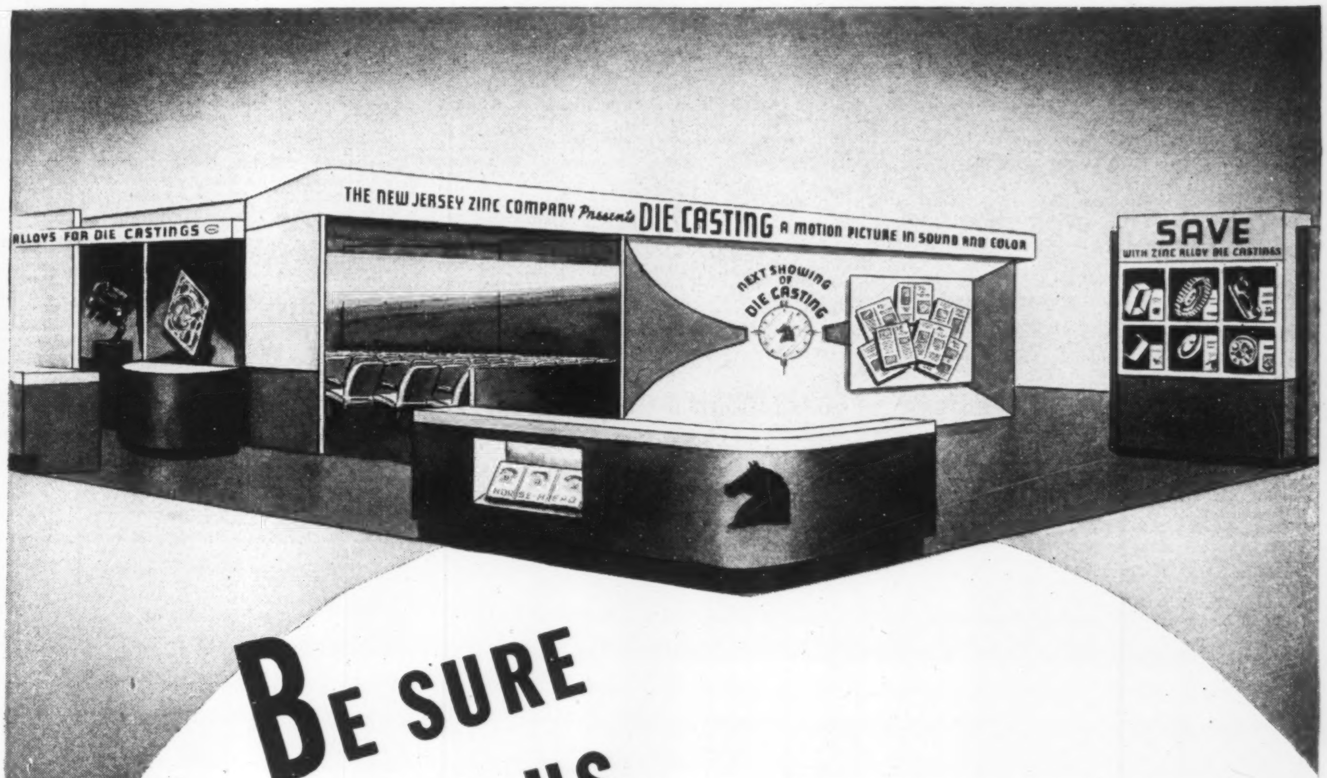
Safetee Glass Co., Philadelphia 44, Pa.
Mirrors—SAFETEE Sealed Brilliance

Saginaw Bearing Co., Saginaw, Mich.
Bearing bronzes—SABECO and AGRICOLA

Sandee Mfg. Co., 5050 Foster Ave., Chicago.
Thermoplastic plastics—SANDEE

Sandusky Foundry & Machine Co., Sandusky, O.
Bronze, brass, manganese bronze and Monel —SANDUSKY

Scovill Mfg. Co., Waterbury, Conn.
Brasses, bronzes, nickel-silvers, phosphor bronzes, coppers, and copper-nickel tubes —ADNIC and OREIDE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Seymour Mfg. Co., 87 Franklin St., Seymour, Conn.
Nickel silvers and phosphor bronzes—SEYMOUR

Sharon Steel Corp., Sharon, Pa.
Standard carbon, alloy and stainless steels—SHARON

Shellmar Products Corp., Mt. Vernon, Ohio.
Laminated thermosetting plastics — SHELLPLI

Shenango-Penn Mold Co., Dover, O.
High-strength alloy castings—SHENANGO-PENN

Sherman & Co., 197 Canal St, New York 13, N. Y.
Silver brazing alloys—NUBRAZE

Shook Bronze Corp., Lima, O.
Bearing bronze—SHOOK Alloy 664

Skoning Corp., 325 Taunton Ave., East Providence, R. I.
Thermosetting plastics—SKO-RESIN

Spaulding Fibre Co. Inc., Tonawanda, N. Y.
Fibre materials — SPAULDING FIBRE, SPAULDING ARMITE and SPAULDO
Phenolic plastics—SPAULDITE

Speer Carbon Co., St. Marys, Pa.
Carbon and graphite—SPEER

Sponge Rubber Products Co., Shelton, Conn.
Hard and soft rubber—CELL-TITE
Sponge rubber—SPONGEX

Stackpole Carbon Co., St. Marys, Pa.
Powder metals—STACKPOLE

Standard Alloy Co., Inc., 1679 Collamer Rd., Cleveland, Ohio.
Nickel-chromium cast steels—STANDARD ALLOY H-R

Standard Tube Co., 14600 Woodward Ave., Detroit 3.
Carbon and stainless steel tubing—STANDARD

Steel & Tube Division, Republic Steel Corp., and 224 East 131st St., Cleveland 8.
Steel and ferrous alloy tubing—ELECTRUNITE

Sterling Alloys Inc., Woburn, Mass.
Standard stainless and heat resistant steel castings—STERMET

The Sterling Varnish Co., Haysville, Pa.
Insulating varnishes—STERLING

Steward Mfg. Co., D. M., Chattanooga 1, Tenn.
Ceramic—LAVITE

Stoody Company, Whittier, Calif.
Hard facing alloys—BOROD, SILFRAM, STOODEX, STOODITE, STOODY SELF HARDENING, STOODY TUBE BORIUM

Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
Steatite ceramic—STUPAKOFF Nos. 621 and 1100, ZIRCITE 1400 and USALITE 1350

Sumet Corp., 1875 Elmwood Ave., Buffalo 7, N. Y.
Bearing bronzes—SUMET

Summerill Tubing Co., Carnegie, Pa.
Seamless tubing—SUMMERILL

Sumner Iron Works, Everett, Wash.
Cast iron—SORBO-MAT

Superior Bearing Bronze Co., 139 Banker St., Brooklyn.
Magnesium castings—SUPERIOR

Superior Carbon Products, Inc., 9115 George Ave., Cleveland, Ohio.
Carbon, graphite and metal-graphite—SUPER GRAPH
Carbon—S.C.P.

Superior Metal Co., Clearing Station, Chicago 38.
Copper-plated strip steel—SUPERIOR

Superior Metal Works, 66th Place at South Oak Park, Chicago 38.
Prefinished strip steel—SUPERIOR

Superior Steel Corp., Carnegie, Pa.
Stainless strip steel—SUPERIOR
Clad steel—SUVENEER

Superior Tube Co., Norristown, Pa.
Welded tubing—WELDRAWN

Surprenant Electrical Insulation Co., Ben, Mass.
Thermosetting plastics—SURCO AMERICAN

Symington-Gould Corp., Rochester, N. Y.
Structural alloys, corrosion, heat and abrasion-resistant alloys—GENESEE
Cast carbon steels—S.G.

Synthane Corp., Oaks, Pa.
Phenolic laminated plastics—SYNTHANE

Syracuse Ornamental Co. Inc., Syracuse, N. Y.
Molded wood—SYROCO and WOODITE

T

Taylor Fibre Company, Norristown, Penna.
Phenolic base thermosetting plastics—TAYLOR FIBRE and TAYLOR PHENOL FIBRE

Taylor-Wharton Iron and Steel Co., High Bridge, N. J.
Manganese, manganese-nickel and magnet metals—TISCO

Technical Plastics Co., 630 Aronimink Place, Drexel Hill, Pa.
Methyl methacrylate—PLASTECH

Technical Ply-Woods, 228 No. LaSalle St., Chicago 1.
Plywoods — DENS-TECH, DIE-TECH, FYBR-TECH, PLY-TECH and MESH-TECH

Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2.
Abrasion-resisting steels—U.S.S. AR STEEL
Alloy steels—U.S.S. CARILLOY
High strength steels—U.S.S. COR-TEN, U.S.S. MAN-TEN
Sheet steels—U.S.S.
Spring steel—U.S.S. PREMIER
Stainless steels—U.S.S. STAINLESS

Tennessee Eastman Corp., Kingsport, Tenn.
Cellulose ester plastics—TENITE

Terre Haute Malleable & Mfg. Corp., Box 180 Terre Haute, Ind.
Gray iron—AFIRON

Thiokol Corp., Trenton, N. J.
Synthetic rubber—THIOKOL

Thomas Steel Co., Warren, O.
Cold-rolled strip steel—THOMASTRIP

The H. I. Thompson Co., 1733 Cordova St., Los Angeles 7, Calif.
High temperature insulating material—REFRASIL

Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.
Abrasion-resistant bearing alloys—GRAPHSIL, GRAPH-MO, GRAPH-M.N.S. GRAPH-AL, and GRAPH-TUNG
Creep-resisting alloy steels—DM STEEL, DM-45, SICROMO STEEL
Corrosion and heat-resistant alloys—SILMO, TIMKEN

Titan Metal Mfg. Co., Bellefonte, Pa.
Welding rods—TITAN and PENN
Corrosion-resistant rods—TITAN
Forging brass—LOGAN and REDALLOY No. 8
Forging bronze—HECLA, HITENSILOY and RESISTALOY
Nickel-silver forging alloy—TI-NIC-O-SIL

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Extra low carbon rimming steel—TAMCO

Tonawanda Electric Steel Casting Corp., 5 Mechanic St., North Tonawanda, N. Y.
Electric steel castings—TESCO

Trenite Corp., P.O. Box 159, Trenton, N. J.
Cast iron—TRENITE

Trent Tube Mfg. Co., East Troy, Wis.
Stainless steel and Inconel tubing—TRENTWELD

True Alloys Inc., 284 S. Summit, Detroit.
Bronze and aluminum alloy castings—TRUALOY

Tube Reducing Corp., 520 Main Ave., Wallington, N. J.
Seamless tubing—ROCKRITE

Tyler, W. S., Co., 3615 Superior Ave., Cleveland.
Abrasion-resisting material—TY-LOY

U

Union Steel Casting Division, Blaw Knox Co., 62nd and Butler Sts., Pittsburgh.
Nickel-vanadium steel—UNIVAN

Unitcast Corp., Steel Casting Div., Toledo 9, O.
Alloy and carbon electric steel castings—T-LOY

United American Metals Corp., 200 Diamond St., Brooklyn 22, N. Y.
Babbitt metals—STONEWALL AMERICAN Marine Genuine and UNITED AMERICAN

United States Graphite Co., Saginaw, Mich.
Porous metal—GRAMIX
Carbon-graphite—GRAPHITAR

United States Gypsum Co., Industrial Sales Div., 300 West Adams St., Chicago 6.
Gypsum cement—HYDROCAL and HYDROSTONE

United States Plywood Corp., 55 West 44th St., New York.
Resin-bonded plywood—WELDWOOD
Metal-covered plywood—ARMORPLY

U. S. Rubber Co., 1230 Sixth Ave., New York.
Natural and synthetic rubber—U. S. RUBBER

United States Steel Corp., 436 Seventh Ave., Pittsburgh.
(See also American Steel & Wire Co., Carnegie-Illinois Steel Corp., Columbia Steel Co., National Tube Co., and Tennessee Coal, Iron & Railroad Co.)
Abrasion-resisting steels—U.S.S. AR STEEL
Alloy steels—U.S.S. CARILLOY
Carbon steels and alloys—U.S.S. AMERICAN QUALITY
Cold-finished steel bars—U.S.S. AMERCUT
High-strength steels — U.S.S. COR-TEN, U.S.S. MANG-NI-CU, U.S.S. MAN-TEN
Sheet steels—U.S.S.
Spring steel—U.S.S. PREMIER
Stainless steels—U.S.S. PREMIER
Tubing, mechanical—U.S.S. SHELBY

United States Stoneware Co., Akron, O.
Chemical stoneware—"U.S." STANDARD
Ceramic nonplastic—VITRIC-10
Plastics bonding resin—REANITE
Resinous thermoplastic—RESILON
Synthetic resins—TYGON
Furane-base plastics—DURALON
Thermoplastic plastics—TYGOFLEX

Universal Clay Products Co., The, Sandusky, O.
Ceramic material—UNIVERSAL

Utica Radiator Corp., 2201 Dwyer Ave., Utica 2, N. Y.
Aluminum and manganese castings—UTICA

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MOLY

V

Valite Corp., Lockport, La.
Laminating resins—VALITE

Vanadium Alloys Steel Co., Latrobe, Pa.
High heat resistant steel alloys—RED-CUT, SUPERIOR, MARVEL and HOTFORM
High-tensile-strength steel alloys—NIKRO M, SILMAN, MOSIL, PAR-EXC, COLONIAL and VANADIUM

Varflex Corp., 305 North Jay St., Rome, N. Y.
Thermoplastic plastics—SYNTHOLVAR

Victor Mfg. & Gasket Co., 5750 Roosevelt Rd., Chicago.
Compressed sheet packing—VICTOPAC
Vegetable fiber base sheet packing—VICTORITE
Asbestos sheet—VICTOR
Cork sheet—VICTOR
Compounded synthetic rubber — VICTOPRENE
Synthetic rubber—VICTOLENE

Visking Corp., The, 34th & Ft. Harrison Rd., Terre Haute, Ind.
Polyethylene thermoplastic plastics—VISQUEEN
Vinylidene chloride thermoplastic plastics—VISKORD

Vulcanized Rubber & Plastics Co., Morrisville, Bucks County, Pa.
Hard rubber—AJAX

W

Wall-Colmonoy Corp., 19345 John Road, Detroit 3.
Hard facing welding rod—COLMONOY

Washington Steel Corp., Washington, Pa.
Cold rolled stainless steel sheet and strip—MICRO-ROLD

Watertown Mfg. Co., Watertown, Conn.
Phenolic, thermosetting material—NEILLITE

Waukesha Foundry Co., Waukesha, Wis.
Copper-base high-nickel alloys—WAUKESHA Metals

Weatherly Foundry & Mfg. Co., Commerce St., Weatherly, Pa.
White iron castings—DIAMITE

Webster Mfg. Inc., Hall St., Tiffin, O.
Pearlitic malleable iron—DURAMAL

Weirton Steel Co., Weirton, W. Va.
Zinc-coated sheets—WEIRZIN
Ductile sheets—WEIRALEAD

Wellman Bronze & Aluminum Co., 6017 Superior Ave., Cleveland.
Bearing bronzes—IDEALOY and ANFRILOY
Copper-base, aluminum and magnesium sand castings—WELLCAST and WELBRONCO

Wellman, S. K., Co., The, 1374 E. 51st St., Cleveland.
Friction material—VELVETOUCH

Wel-Met Co., 110 Gougler Ave., Kent, O.
Sintered bronze and iron—WEL-MET

Werner Co. Inc., R. D., 380 Second Ave., New York.
Thermoplastic flexible tubing — PLASTIKFLEX

West Coast Plastics Enterprises, No. 67, 4891 Huntington Drive, Los Angeles 32.
Phenol formaldehyde thermosetting materials —IVORICAST

Western Brass Mills, Div. of Olin Industries Inc., East Alton, Ill.
Copper-base alloys—WESTERN

Western Felt Works, 4117 Ogden St., Chicago.
Felt material—WESTFELT
Laminated felt and Neoprene—RESISTOFELT
Felt-rubber material—GASKOFELT
Synthetic rubbers—ACADIA

Westinghouse Electric Corp., East Pittsburgh, Pa.
Silicon-iron—HIPERSIL
Iron-nickel—CONPERNIK and HIPERNIK
Copper-base alloy—CUPALOY
Nickel-chromium-cobalt-iron alloy—K-42-B
Iron alloy—KOVAR A
Iron-cobalt alloy—HIPERCO
Phosphorus-copper—PHOS-COPPER
Thermosetting plastics—MICARTA

Wheelock, Lovejoy & Co. Inc., 128 Sidney St., Cambridge, Mass.
Alloy steels—HY-TEN and ECONOMO

Wilmington Fibre Specialty Co., Wilmington, Del.
Paper base material—FYBEROID
Cotton rag and paper, nonplastic—WILMINGTON FIBRE
Phenolic plastics—OHMOID

Wilson Co., H. A., 105 Chestnut St., Newark 5, N. J.
Contact and thermostatic metals—WILCO
Titanium-chromium-nickel alloy—NI-SPAN C

Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., 1417 Central Ave., Detroit 9.
Tubing—WOLVERINE

Alan Wood Steel Co., Conshohocken, Pa.
Alloy steels—DYNALLOY and AW DYNALLOY
Rolled-steel floor plate—AW

Worcester Wire Works, Div. of National Standard Co., Worcester, Mass.
Steel wire—WORCESTER Wire

Worthington Pump & Machinery Corp., Harrison, N. J.
Corrosion and abrasion-resistant alloy—WORTHITE

Wyckoff Steel Co., First National Bank Bldg., Pittsburgh.
Cold-finished steels—WYCKOFF

Y

Youngstown Alloy Castings Corp., Youngstown, O.
High tensile strength alloy—TRANTINYL

Youngstown Sheet & Tube Co., Youngstown, O.
High strength alloy steel—YOLOY

Expanded Metal Meshes
Provide Greater Strength
with Less Weight
PENMETAL STEELMESH
Expanded Metal
EXPANDED METAL MESHES
PENN METAL COMPANY, INC.

In the fabrication of Penmetal Steelmesh, the steel plate is simultaneously slit and expanded. Steelmesh has greater strength per square foot—pound for pound—than any other material and is especially useful wherever lightweight with strength is essential. A minimum weight of steel is utilized as one square foot of steel sheet is expanded to become from four to five square feet of Steelmesh.

Suitable for the fabrication of a multitude of products. Can be cut, shaped and welded without raveling or joint failures.

Write for catalog and samples.

APPROXIMATE SIZES, DIMENSIONS AND WEIGHTS

	STANDARD STEELMESH						FLATTENED STEELMESH				
Style Designation	U. S. Standard Gauge Steel Used	Weight in Lbs. Per Sq. Ft.		Stock Sizes of Sheets	Size of Mesh from Centers of Bridges		Weight in Lbs. Per Sq. Ft.		Stock Sizes of Sheets	Size of Mesh from Centers of Bridges	
		Plain	Galv.		Width	Length	Plain	Galv.		Width	Length
½″–#20	20	.50	.63	3′ & 6′ x 8′	.45″	1.2″	.47	.63	3′ & 4′ x 8′	.46″	1.28″
½″–#18	18	.74	.91	3′–4′ & 6′ x 8′	.45″	1.2″	.70	.91	3′ & 4′ x 8′	.46″	1.28″
½″–#16	18	.81	.97	4′ x 8′	.45″	1.2″	.77	.97	4′ x 8′	.46″	1.28″
¾″–#16	16	.50	.59	3′–4′ & 6′ x 8′	.95″	2.0″	.47	.59	3′ & 4′ x 8′	.97″	2.13″
¾″–#13	13	.80	.92	3′–4′ & 6′ x 8′	.95″	2.0″	.76	.92	3′ & 4′ x 8′	.97″	2.13″
1½″–#18	18	.20	.25	2′ & 4′ x 8′	1.34″	3.0″	.....	.....	.....	.....	.....
1½″–#16	16	.40	.48	2′ & 4′ x 8′	1.34″	3.0″	.38	.48	2′ & 4′ x 8′	1.34″	3.20″
1½″–#13	13	.60	.68	4′ & 6′ x 8′	1.34″	3.0″	.57	.68	3′ & 4′ x 8′	1.34″	3.20″
1½″–#10	13	.79	.89	4′ & 6′ x 8′	1.34″	3.0″	.75	.89	3′ & 4′ x 8′	1.34″	3.20″

METAL MARK
Penmetal
1869
OF QUALITY

PENN METAL COMPANY, INC.

Dept. 30, Parkersburg, W. Va.

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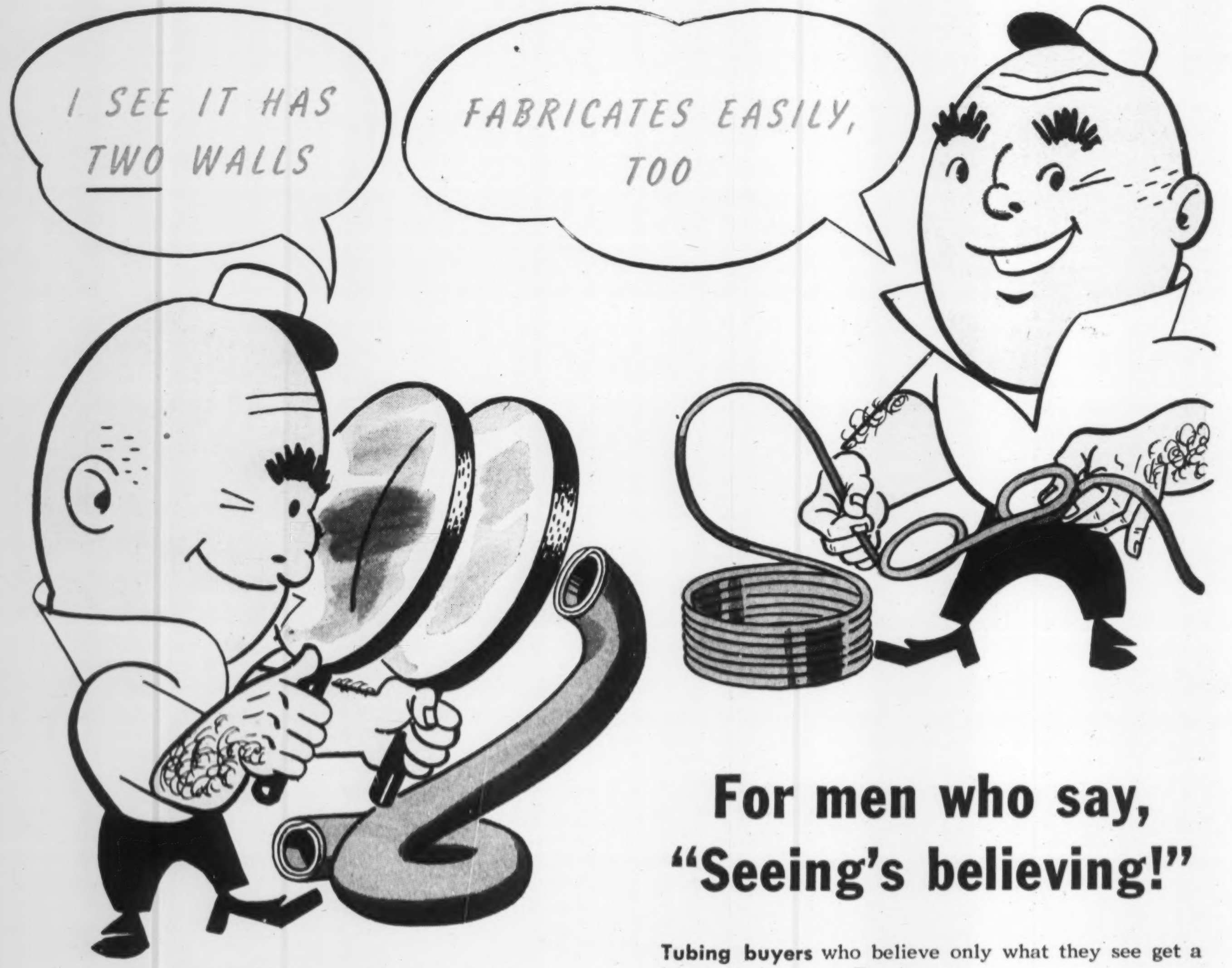


For men who say, "Seeing's believing!"

Tubing buyers who believe only what they see get a hearty welcome at Bundy.

When they look at Bundyweld* Tubing, we know what they are going to learn—and we know they're going to like it.

They're going to see solid, double wall tubing of great strength—yet, it fabricates with ease.

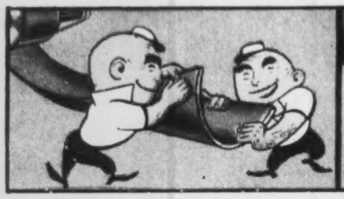
A further look will show them how Bundyweld Tubing can give greater dependability to their product at economical prices.

Look at these important advantages made possible through the patented Bundyweld process:

- **solid, double wall**
- **great resistance to vibration fatigue**
- **strength combined with ductility**
- **uniform tolerances**
- **ease of fabrication**
- **high bursting strength for pressure applications**
- **low cost**

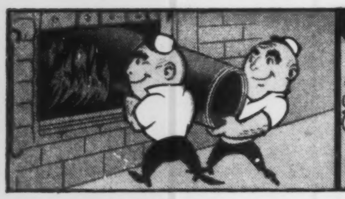
Your tubing problems will get better answers from Bundyweld. Write today. *Bundy Tubing Company, Detroit 14, Michigan.*

WHY BUNDYWELD IS BETTER TUBING

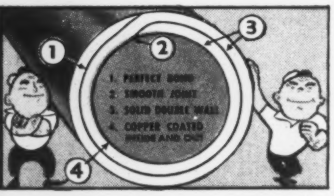


1 Bundyweld Steel Tubing is made by a process entirely different from that used in making other tubing. A single strip of copper-coated S.A.E. 1010 steel is continuously rolled twice laterally . . .

2 . . . into tubular form. Walls of uniform thickness and concentricity are assured by the use of close tolerance cold rolled strip. This double rolled strip passes through a furnace where the . . .



3 . . . copper coating fuses and alloys with the double steel walls. After brazing and cooling, it becomes a solid double wall steel tube, copper brazed throughout 360° of wall contact . . .



4 . . . copper coated inside and out, free from scale, closely held to dimensions. Hard or annealed in standard sizes up to 5/8" O.D. Special sizes cold drawn. Also in Monel and nickel.

*REG. U.S. PAT. OFF.

BUNDY TUBING

ENGINEERED TO YOUR EXPECTATIONS ®

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Pacific Metals Co., Ltd.
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3333 W. 47th Place
Chicago 32, Illinois

Rutan & Co.
404 Architects Bldg.
Phila. 3, Pa.

Eagle Metals Co.
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Alloy Metal Sales Ltd.
861 Bay St.
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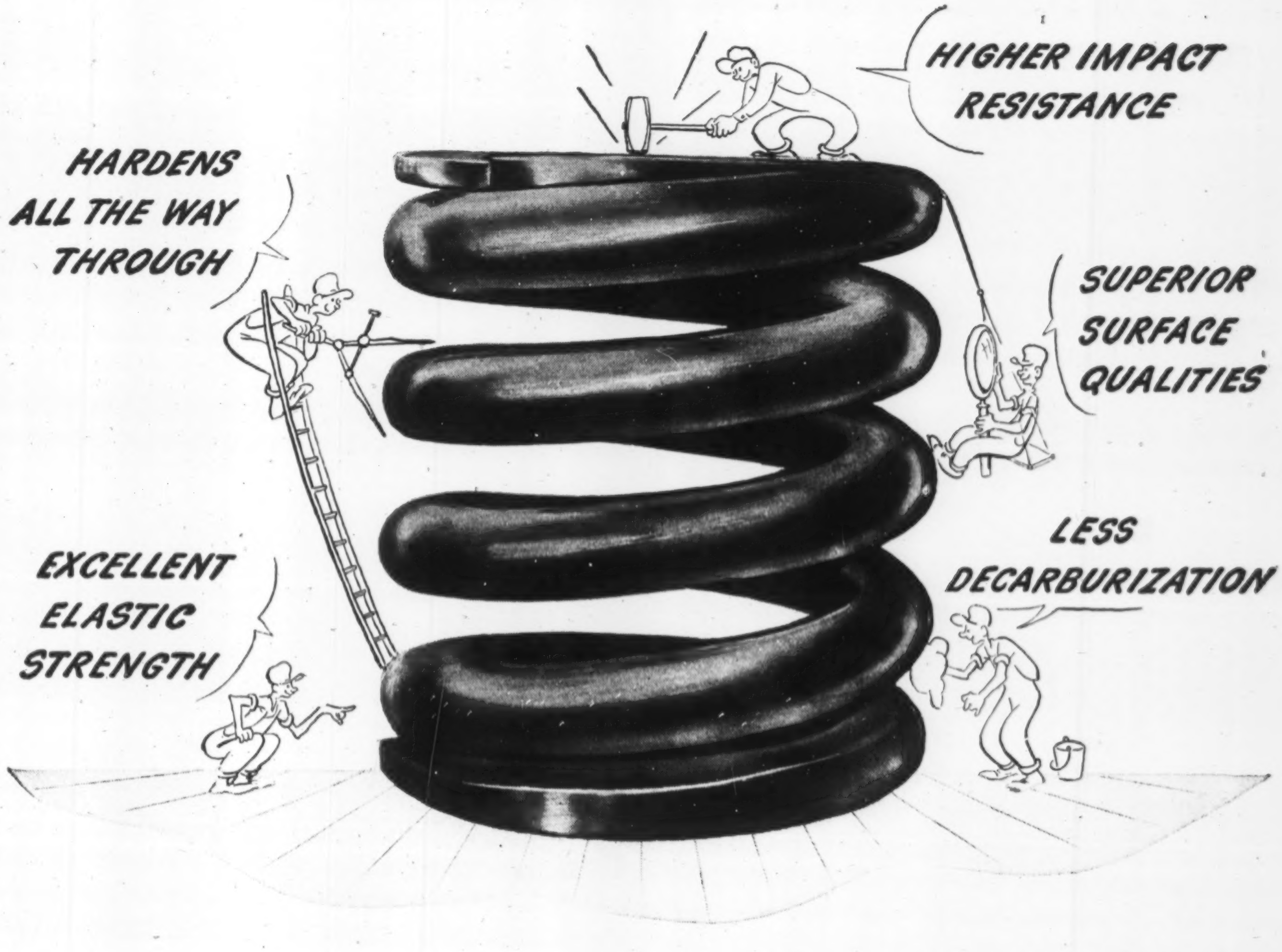
Hot Coiled Springs Last Longer

when made of

Type "8655" Nickel Alloy Steel


HIGHER IMPACT RESISTANCE
HARDENS ALL THE WAY THROUGH
SUPERIOR SURFACE QUALITIES
LESS DECARBURIZATION
EXCELLENT ELASTIC STRENGTH

Here's a steel that offers remarkable advantages for all types of heavy-duty springs . . . great shock resistance at normal and sub-zero temperatures, high elastic properties that resist permanent set, good hardenability . . . to mention a few.

It will pay you to investigate Type "8655" Nickel alloy steel for springs used in railway car suspensions, draft gears, snubbers . . . for tractors, rolling mills, heavy forging machinery, or other heavy-duty applications.

EMBLEM OF INCO SERVICE
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Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

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Power goes to work smoothly through

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SLEEVE BEARINGS

Made from REVERE TUBE

See REVERE for Tube in

COPPER • COPPER ALLOYS

ALUMINUM • MAGNESIUM • STEEL

(The products illustrated were fabricated from Revere Copper and Copper Alloy Tube, and in some cases from sheet and strip as well)

COPPER **BRASS**

REVERE
Tube is Versatile

. . . RESISTS CORROSION. Revere Copper and Brass Tube have excellent corrosion resistance, which is one, but only one reason why tube of these fine metals is so attractive to industry. Its resistance to most of the corroding factors commonly present in liquids, gases, and air is a big advantage. If your product calls for unusual corrosion-resistance, we can arrange for a Revere Technical Advisor to help you determine the most serviceable alloy for your needs.

. . . IS EASY TO WORK. No matter if your product is simple electrical terminal lugs or complicated oil refining equipment, Copper and Brass Tube simplifies your manufacturing problems. You can easily bend most types of Copper Tube to meet installation needs. If Copper Tube is to be machined, Free-Cutting Copper is preferred. When machining is necessary on Brass Tube, we recommend the use of Leaded Brass Tube for easy and fast cutting. This ease of fabrication speeds up your assembly line.

. . . IS MADE TO CLOSE TOLERANCES. The full wall thicknesses and close gauge tolerances of Revere Tube help to speed up and simplify your manufacturing processes. When you use Yellow Brass or Leaded Brass Tube for machining, you can start with a tube of accurate dimensions and hold to close tolerances at high production speeds because the metal cuts freely and cleanly.

. . . COMES IN SPECIAL SHAPES. In addition to the standard sizes of round tube, Revere Tube can be obtained on order in an almost unlimited variety of profiles—oval, hexagonal, square, or whatever is required. Revere maintains a large stock of different drawing dies and is prepared to make and maintain special dies for individual use.

. . . HAS A LONG LIFE. It gives long service because of its corrosion-resistance and other durability features. You or your mechanics don't have to waste time and money tearing down equipment for complicated repairs and replacements. Consumer products using it enhance your reputation.

. . . REDUCES HEAT LOSS. Copper and Brass Tube carries heated air, liquids, and gases with little heat loss. With Revere Copper Tube for example, the total heat loss due to convection and radiation is about half that for black iron pipe of the same nominal size.

. . . IS A GOOD HEAT CONDUCTOR. Copper Tube transmits heat readily and warms quickly when a warm liquid passes through. This makes fats, grease, and similar substances flow through in a liquid state, reducing any tendency to clog.

. . . REDUCES FLOW RESISTANCE. The smooth gun-barrel interior finish of Revere Copper and Brass Tube allows liquids to flow through it rapidly with minimum friction. When solder fittings are used, there are no projections or recesses to obstruct the flow.

. . . IS AN IDEAL ELECTRICAL CONDUCTOR. High electrical conductivity is especially important to the electrical equipment manufacturer. Revere Deoxidized Copper Tube has a rating of 75-90 per cent. I. A. C. S. electrical conductivity at 68° F., Cartridge Brass Tube has a rating of 28 per cent, and Leaded Brass has a rating of 26 per cent.

. . . REQUIRES LITTLE FINISHING. This tube has a smooth, attractive finish. When it is made into manufactured articles, this reduces polishing and buffing time.

. . . IS EASY TO SOLDER OR WELD. You can solder, weld, or braze Copper and Brass Tube rapidly and economically.

. . . IS EASY TO PLATE. You save money when you make plated parts from Copper and Brass Tube. It is a simple matter to plate the tube with chromium, nickel, silver, gold, rhodium, and many other metals. It is equally simple to apply other finishes, such as paint and lacquer.

. . . IS ECONOMICAL. The ease with which Revere Tube can be made into finished products results in economical manufacture. The user enjoys the ultimate economy of having a long-lived article requiring a minimum of maintenance, which adds to your reputation as a maker of fine goods.

. . . HAS HIGH SCRAP VALUE. Nearly any kind of scrap you make during fabrication of Copper or Brass Tube has a market value. About the only exceptions are filings and dust. Likewise, if you scrap part or all of a Copper or Brass Tube installation due to obsolescence for example, you can realize a favorable return on the metal. These economies are highly appreciated by all experienced users of copper and brass.

THE BIGGEST ADVANTAGE OF ALL IS SUPERIOR QUALITY

The word Revere on a length of Copper or Brass Tube has long been a guarantee of the ultimate in high quality. Generations of manufacturing experience, plus modern production methods, strict metallurgical controls, and frequent inspections ensure that every foot of Revere Tube conforms to the same exacting standards.

THESE THREE ALLOYS MEET MOST MANUFACTURING REQUIREMENTS

REVERE COPPER TUBE—Alloy No. 101 (Deoxidized Copper) (Copper 99.90% minimum, phosphorus 0.025%).

General properties: Revere Deoxidized Copper is extremely corrosion-resistant, has high ductility, welds and solders readily. It is furnished in hard or soft tempers.

Typical uses: Revere Copper Tube is recommended for industrial piping of liquids; compressed air, gas, and refrigeration lines; feed lines and piping in electric power and light plants; locomotive water systems; automobile radiators, heaters, oil lines, brake systems, and gasoline lines.

Working properties: Cold working, hot working, soldering, polishing—excellent. Machining—Free-Cutting Copper preferred. Welding—gas, carbon arc, and metal arc.

ASTM specifications: B13, B42, B68, B75, B88, B111.

REVERE CARTRIDGE BRASS TUBE — Alloy No. 161 (Copper 70%, zinc 30%).

General properties: This is the metal used for shell cases and cartridges in the war. It has the best combination of ductility and strength of all the brasses and consequently it has superior cold working properties. It is hard drawn, stress relieved.

Typical uses: Revere Cartridge Brass Tube is recommended for automobile windshield wipers, warp bars or beams in textile machinery, plumbers' brass goods, fire-fighting equipment, toys, automatic pencils, fishing tackle, vacuum cleaners, electric fixtures.

Working properties: Cold working, soldering, polishing — excellent. Hot working — good. Machining—Leaded Brass recommended. Welding—gas, carbon arc, metal arc, spot and seam welding for thin gauge.

ASTM specifications: B135 No. 2.

REVERE HIGH-LEADED BRASS TUBE—Alloy No. 222 (Copper 67.0%, zinc 31.4%, lead 1.6%).

General properties: Free machining combined with moderate cold-forming ability. It is hard drawn, stress relieved.

Typical uses: Screw machine parts, electrical fuse parts, manufactured articles requiring machining or threading.

Working properties: Cold working—fair. Hot working—poor. Machining—good. Welding—non-leaded brass preferred. Soldering—excellent. Polishing—excellent.

ASTM specifications: B135 No. 4.

REVERE Tube is also made in these metals—Electrolytic Copper, Free-Cutting Copper, Silver-Bearing Copper, Arsenical Copper, Oxygen-Free Copper, Red-Brass, 85%, Muntz Metal, Admiralty Metal, Aluminum Alloys, Magnesium Alloys.

LOCKSEAM TUBE

Revere can supply Lockseam Tube in a wide range of shapes and sizes, and in practically all commercial metals. This tube is extensively used for automotive radiators, casket and grave vault handles, appliance and implement handles, light structural applications, electrical apparatus, and for ornamental purposes.

ELECTRIC WELDED STEEL TUBE

Revere also makes Electric Welded Steel Tube, widely used in the manufacture of parts and products not requiring the high corrosion resistance of copper and its alloys. This tube is supplied in round, square, rectangular, oval, and in special shapes to your designs. It may of course be bent, flanged, rolled, machined and otherwise worked, and can be polished, plated, enameled or painted.

ALUMINUM TUBE

Revere Aluminum Tube is used for furniture, hand and stair rails, for conducting liquids and gases, for refrigeration, and wherever a lightweight, strong, corrosion-resistant tube is needed. Available in 2S, 3S, 4S, 24S, 52S and 61S alloys; 24S and 61S can be furnished either soft or heat-treated; the others annealed or in various tempers.

REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
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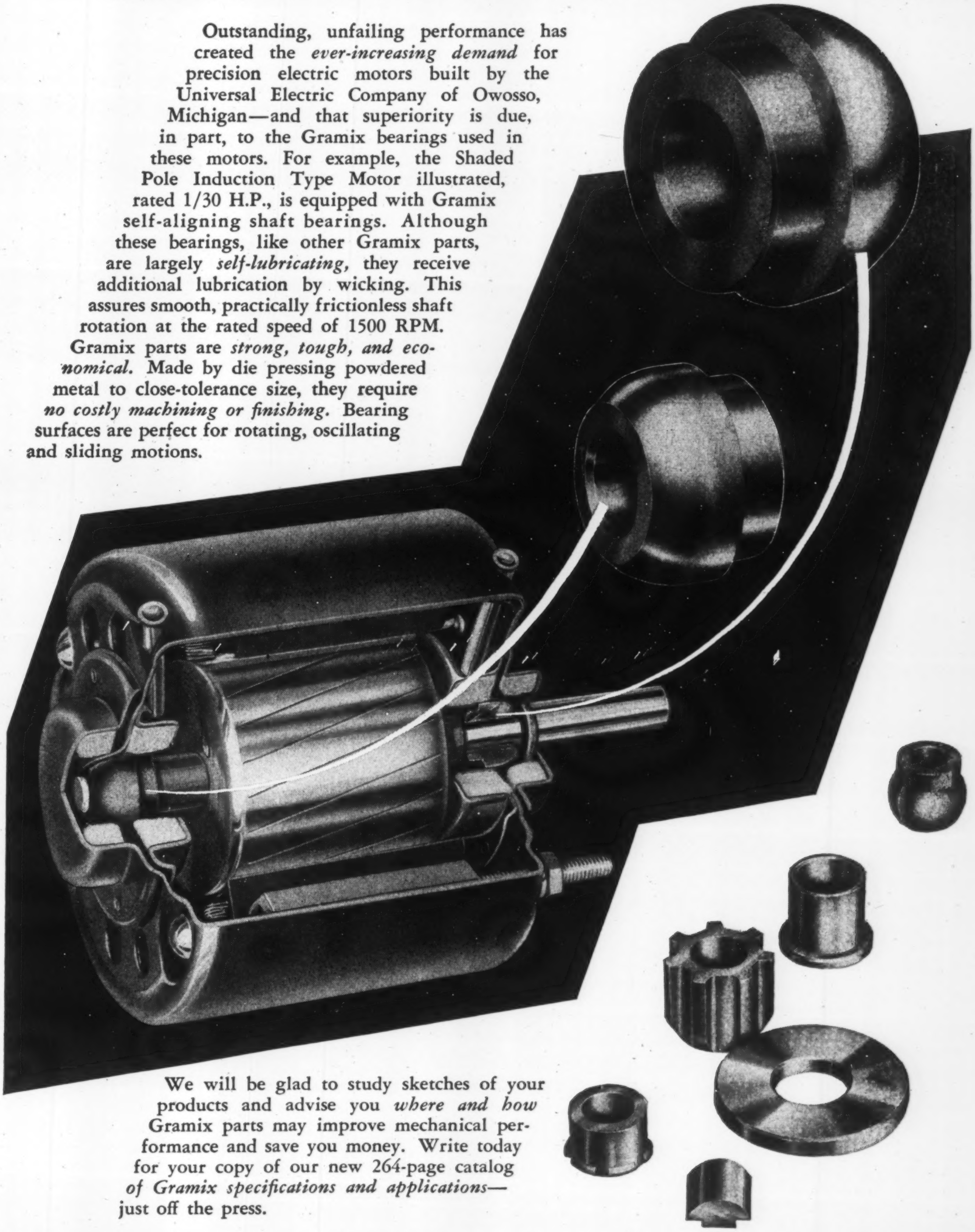
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

gramix bearings help increase demand for Universal electric motors

Outstanding, unfailing performance has created the *ever-increasing demand* for precision electric motors built by the Universal Electric Company of Owosso, Michigan—and that superiority is due, in part, to the Gramix bearings used in these motors. For example, the Shaded Pole Induction Type Motor illustrated, rated 1/30 H.P., is equipped with Gramix self-aligning shaft bearings. Although these bearings, like other Gramix parts, are largely *self-lubricating,* they receive additional lubrication by wicking. This assures smooth, practically frictionless shaft rotation at the rated speed of 1500 RPM. Gramix parts are *strong, tough, and economical.* Made by die pressing powdered metal to close-tolerance size, they require *no costly machining or finishing.* Bearing surfaces are perfect for rotating, oscillating and sliding motions.



We will be glad to study sketches of your products and advise you *where and how* Gramix parts may improve mechanical performance and save you money. Write today for your copy of our new 264-page catalog *of Gramix specifications and applications*—just off the press.

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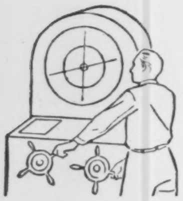
You Always Look at the Barrels Before You Buy

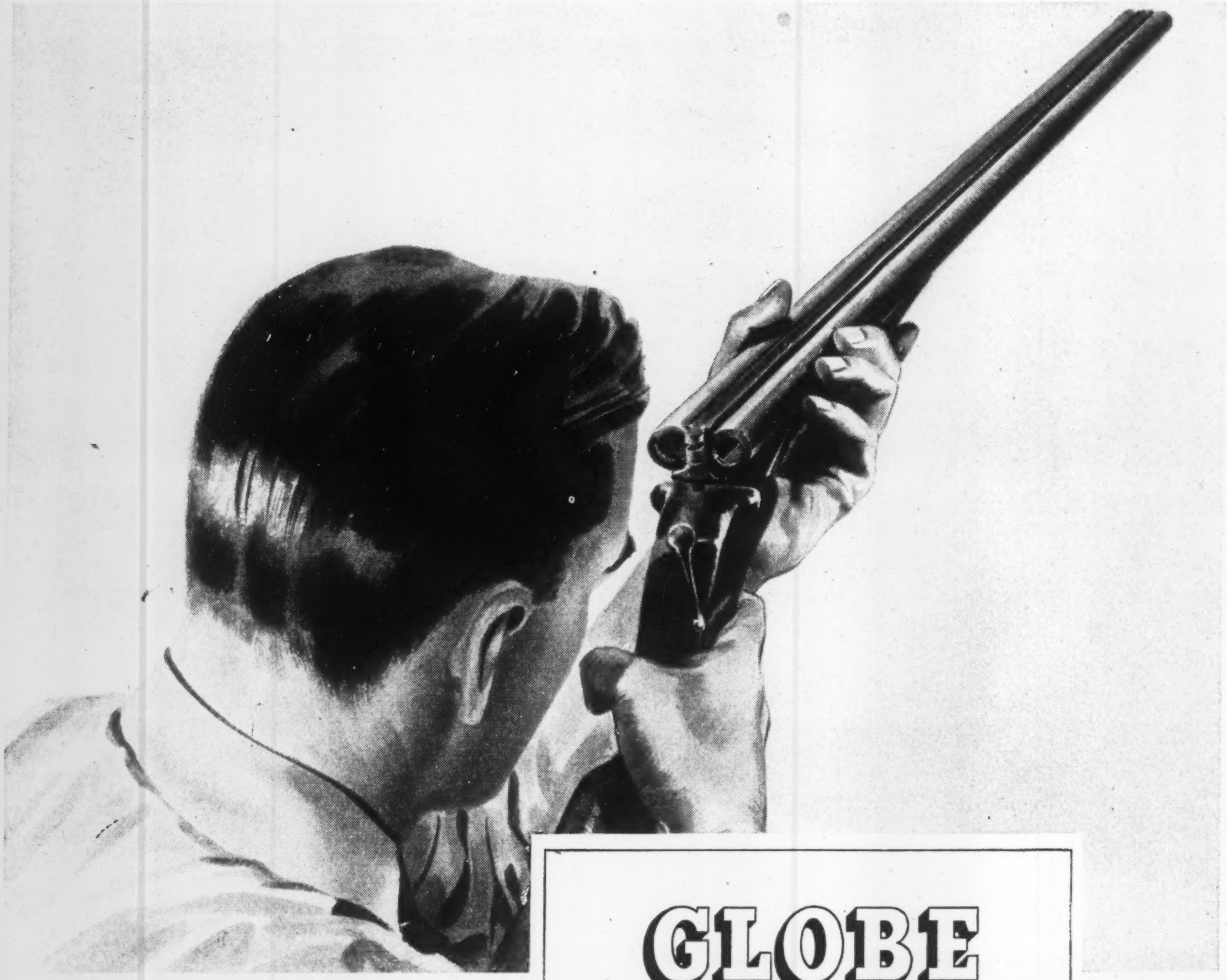


Why? Because you want gun-barrels that are structurally perfect tubes — with a superlatively fine finish — no scratch, pit or blemish inside and the satin smooth outside finish that usually bespeaks true craftsmanship in fire-arms.

Your requirements in steel tubes may be equally exacting — yet you wouldn't want to take the time to check the uniformity and quality of every tube in a carload shipment. Because Globe specializes in tubing manufacture, our plant is equipped with every scientific means to control uniformity and quality at every stage of production — from raw steel billet to finished tube.

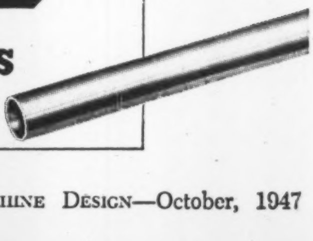
Get exactly what you want in tubes — from Globe — in seamless carbon, alloy, stainless steels or Globeiron high purity ingot iron tubing — or Gloweld welded stainless steel tubing.

Globe Steel Tubes Co., Milwaukee 4, Wisconsin



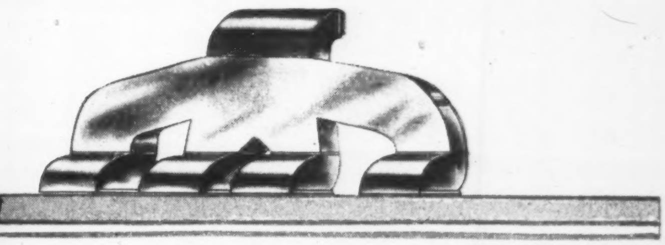
GLOBE

STEEL TUBES



Seamless Tubes—Carbon—Alloy—Stainless Steels—Welded Stainless Steel Tubing—Gloweld—High Purity Ingot Iron Seamless Tubes—Globeiron Mechanical Tubing—Pressure Tubing—Tubing for Corrision and Heat Resisting Applications.

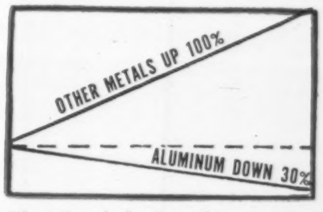
WHAT HAVE ALUMINUM DUCTS GOT TO DO WITH MY PROBLEM?



JUST this—they prove that aluminum, in case after case, costs less than the materials you are now using when all its advantages are known and capitalized on fully.

"Too costly," said sheet metal contractors when first approached by Reynolds on fabricating ducts from aluminum sheet. But they discovered that pound for pound aluminum offered *three times* the working area of galvanized sheet steel. That its light weight made for important fabrication and erection economies. So, today, with steel prices up and aluminum at an all-time low, the final cost of this premium material is actually lower—and they're getting immediate deliveries. What's more, the customer (a good man to remember these days) is receiving, at no extra cost, rustproof duct work that will last a lifetime.

Yes, there are many factors that go to make up the true cost of aluminum. Failure to consider them all may be costing you the benefits of this modern metal. Reynolds technicians will welcome the opportunity to work with you in the use of aluminum for the betterment of your products and profits. For complete information contact your local Reynolds Sales Office or write Reynolds Metals Company, 2521 S. Third Street, Louisville 1, Kentucky.



The price of aluminum has gone down 30% since Reynolds became a primary producer in 1939.

Visit Reynolds at the
National Metal Show,
Chicago, Oct. 18-24,
Booths 319-323.

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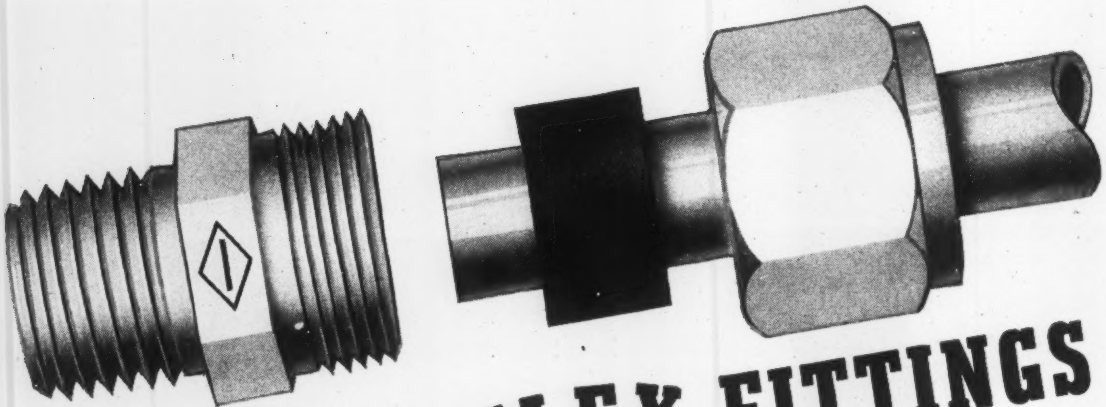
THE GREAT NEW SOURCE OF **ALUMINUM**

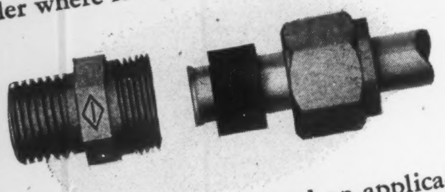
INGOT • SHEET • SHAPES • WIRE • ROD • BAR • TUBING • PARTS • FORGINGS • FOIL • POWDER



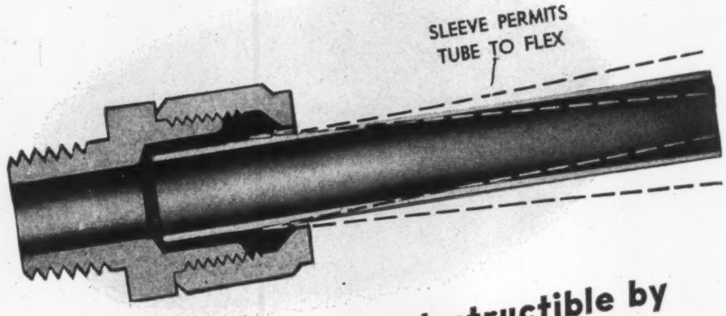
IMPERIAL FLEX FITTINGS

. . . the tube coupling with the vibration and shock absorbing sleeve

Easy to Install . . . All that is necessary is to slip nut and Flex sleeve over tubing. Then insert tubing into fitting body as far as it will go, and assemble. This applies to sizes ½″ O.D. and smaller where low pressures are involved.



On sizes larger than ½″ O.D and on applications where higher pressures are involved, end of tube should be belled slightly, as shown in illustration above.

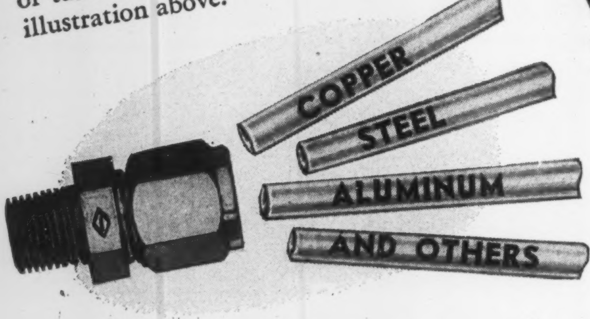


Makes Joints Virtually Indestructible by Vibration . . . . The Flex Fitting embodies a sleeve of special synthetic elastic material which permits the tubing to flex back and forth through the angle shown and at the same time assures a positive, pressure-tight seal.

It assures a safe, durable tubing installation that will withstand major vibration, minor tube movement and considerable mechanical shock without damage to either tubing or fittings. On tests where ordinary fittings failed after 73,000 cycles of vibration, Imperial Flex Fittings have withstood over 20,000,000 cycles without failure.

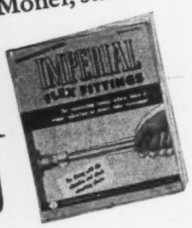
Flex Fittings eliminate the need for costly flexible hose lines in many instances.

Proved by extensive service in the field. Used as standard equipment on trucks, tractors, diesel engines, oil filter connections, heavy power equipment, machinery, etc.



For All Kinds of Tubing . . . . . . Imperial Flex Fittings can be used with all types of seamed and seamless metal tubing, including copper, aluminum, thin-wall steel, Monel, stainless steel, etc.

Catalog No. 344 gives complete engineering data on Flex Fittings including types, sizes, dimensions, specifications and application information. **Write for your copy.**



Emblem of Quality

IMPERIAL

THE IMPERIAL BRASS MANUFACTURING COMPANY
513 S. Racine Ave., Chicago 7, Illinois

PIONEERS IN TUBE FITTINGS AND TUBE WORKING TOOLS

Reduces Cost of Machine Base 40% by Change to Welded Steel

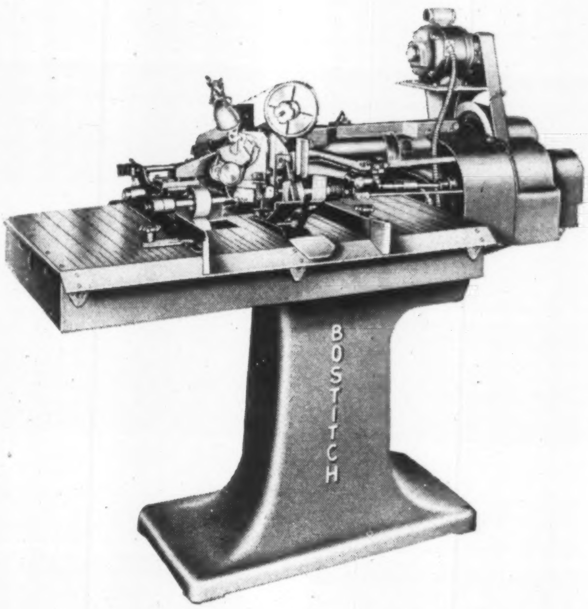


Fig. 1. The Bostitch Stitcher with conventional base.

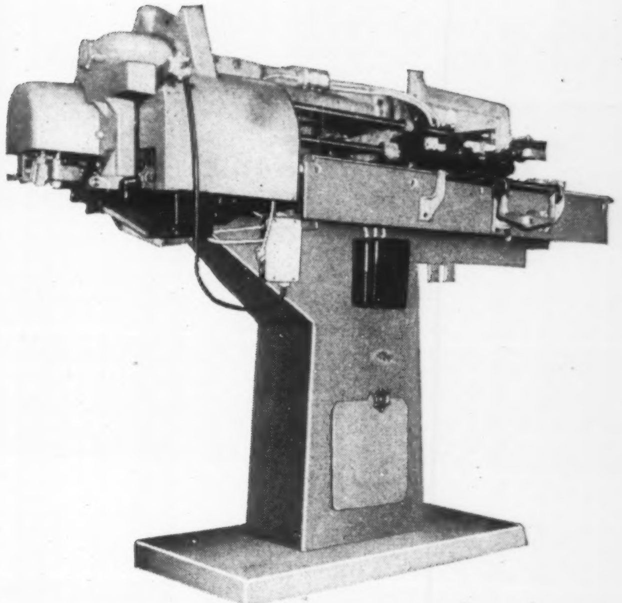


Fig. 2. Rear view of same machine, mounted on new welded base which cost 40% less.

By R. H. Dell, Chief Engineer
Boston Wire Stitcher Company, Westerly, R. I.

CONFRONTED with ever-rising casting costs for the base of the Bostitch Automatic Box Stitcher, we decided to try welded steel design. The result is a base that costs 40% less and is 30% lighter in weight.

Fig. 1 shows the Stitcher with its original base of conventional design, and Fig. 2 shows the same machine, photographed from the opposite side, mounted on the new welded base.

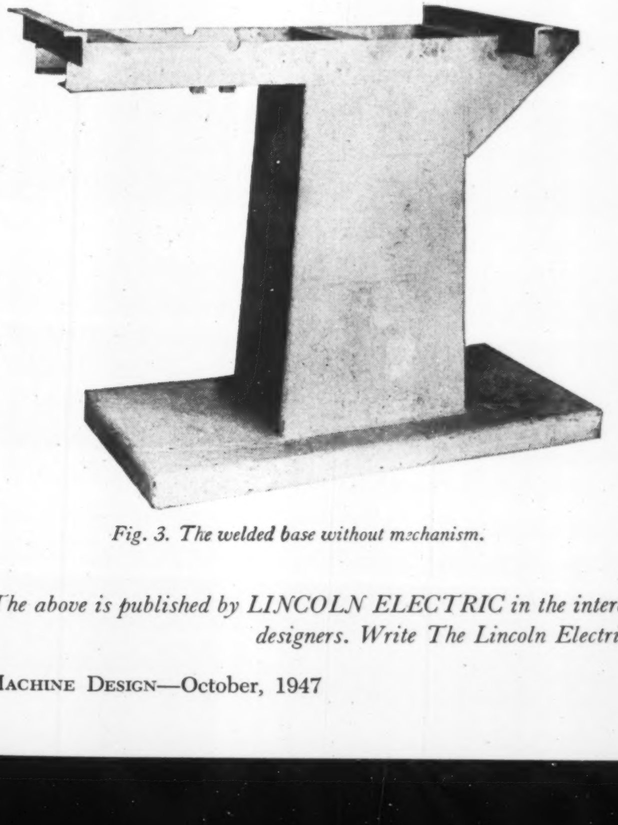


Fig. 3. The welded base without mechanism.

We had been getting the base from an outside foundry and wished to continue having it fabricated outside, so asked commercial welderies for prices on the welded base. This put the former design and the welded design on the same competitive basis.

The lowest bid on the welded base was 40% less than the price we had been paying for the former design. There was also a weight reduction of 30%, the welded base weighing only 525 pounds as compared with the former design's weight of 750 pounds.

Fig. 3 is a close-up of the welded base. The main designing consideration was the great amount of pounding it takes, due to the action of the mechanism in making up to 400 stitches per minute in heavy cardboard containers.

The pedestal, of liberal dimensions to counteract vibration, is one piece of 5/16″ plate. Corners are notched out, sides bent down and butt-welded at the corners. The column is four pieces of 5/16″ plate, flame-cut to shape and corner welded. To minimize material at the top of the column, bare angle irons 3/8″ thick are used for the table mountings. The gusset support had to be extremely strong to absorb the main impact loads, so its top support plate is 1″ thick and sides and bottom are 1/2″ plates.

All welds are single pass, square butt welds, not scarfed. "Fleetweld 7" electrode is used.

After changing to the welded base, we discovered an additional market for the same machine with the base 10½″ shorter. To make the adaptation, all we did was cut 10½″ off the bottom of the vertical column before the weldment was assembled. This flexibility of welded design gives us a further advantage.

The above is published by LINCOLN ELECTRIC in the interests of progress. Machine Design Studies are available to engineers and designers. Write The Lincoln Electric Company, Dept. 357, Cleveland 1, Ohio.

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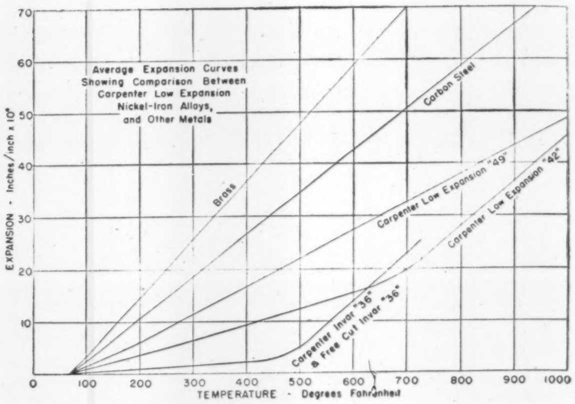
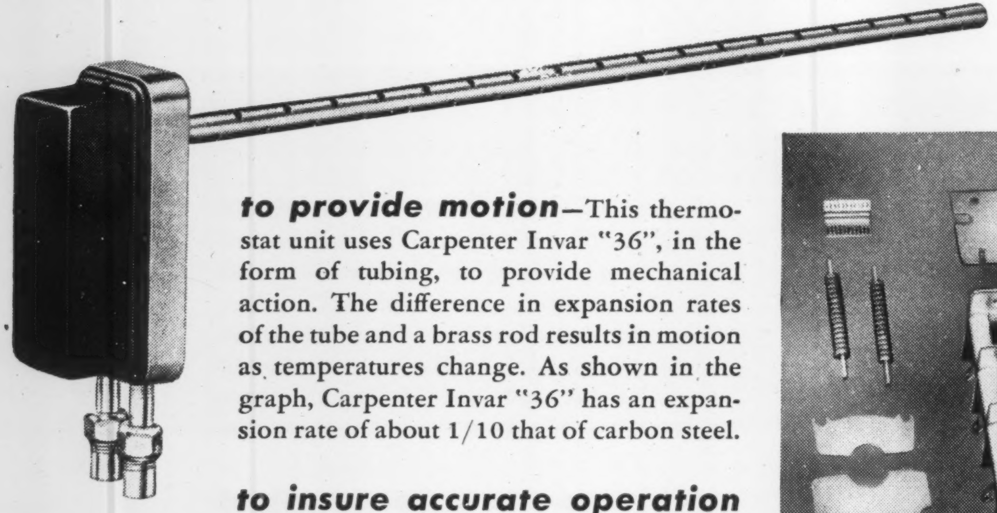
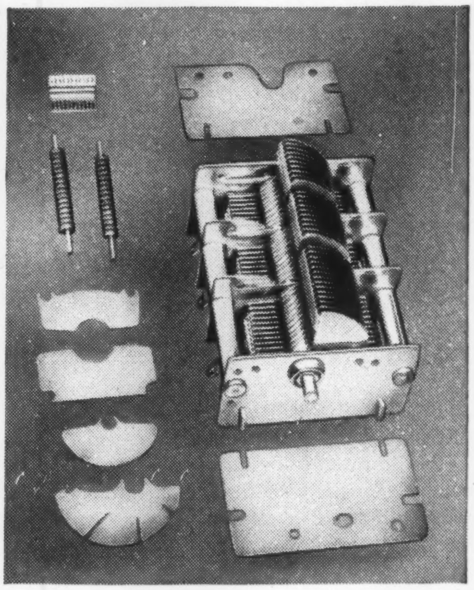




to provide motion—This thermostat unit uses Carpenter Invar "36", in the form of tubing, to provide mechanical action. The difference in expansion rates of the tube and a brass rod results in motion as temperatures change. As shown in the graph, Carpenter Invar "36" has an expansion rate of about 1/10 that of carbon steel.

to insure accurate operation—Precision instruments such as condensers, regulators, electronic devices, etc., remain accurate through temperature ranges up to 400°F. This variable condenser is built almost entirely of Carpenter Invar "36". Shafts are of Carpenter Free-Cut Invar "36".



Carpenter
High Nickel Alloys

ENGINEERING INFORMATION on Carpenter Invar "36" and Carpenter Free-Cut Invar "36" is provided by a new booklet describing Carpenter High Nickel Alloys. The booklet includes the Carpenter "Map" of Iron-Nickel Alloy Characteristics and application data on each alloy. A note on your company letterhead, indicating your title, will start your Carpenter High Nickel Alloy Bulletin on its way.

The Carpenter Steel Company, 120 W. Bern Street, Reading, Pa.

Carpenter
High Nickel Alloys

- Temperature Compensator "30"
- Carpenter Invar "36"
- Carpenter Free-Cut Invar "36"
- Glass Sealing "42"
- High Permeability "49"

Sure... You know Cellular Rubber!

But . . . do you know how it can be *Molded and Shaped* to serve you?

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Methods developed in our laboratories enable us to control density, tensile strength, resistance to oils and greases . . . chemicals . . . oxidation. Among the proven uses for our varied line of sub-density materials are: Sealing, Insulating, Cushioning, Dampening sound or vibration, Protective Packaging, Gasketing, Space Filling and Weatherstripping. One or more of these qualities may easily improve your product's efficiency, lengthen its working life.

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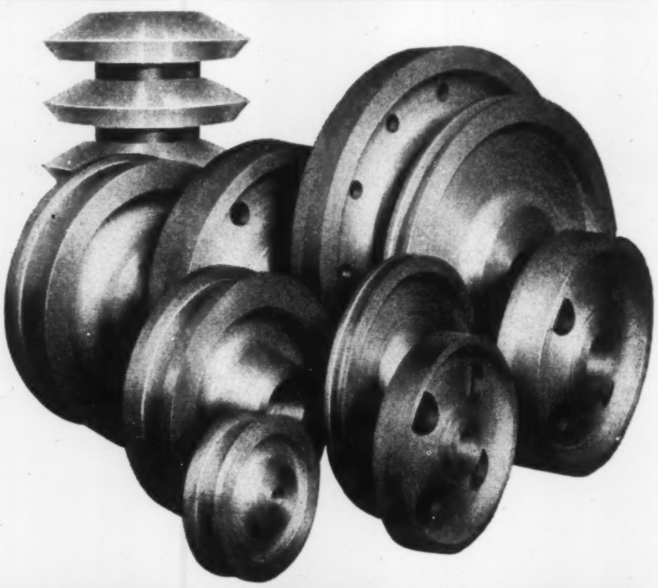
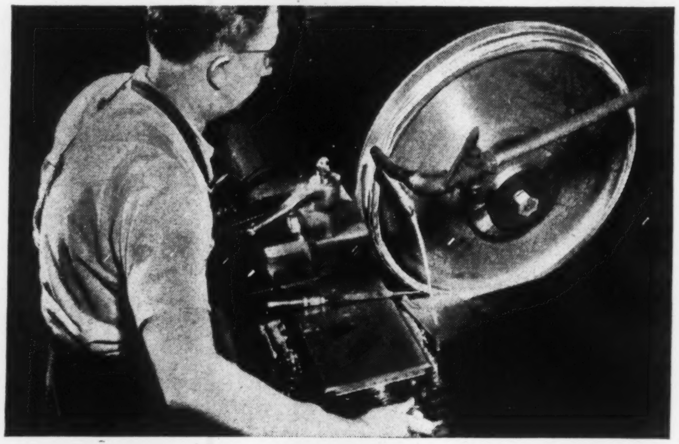


Maybe it's an old story by now — the advantages of Bethlehem's rolled-and-forged circular products. But old or new, the facts are as true as ever, and just as important to designers and manufacturers.

For years Bethlehem circular steel blanks have been widely used in the production of gears, crane wheels, sheave wheels, turbine rotors, industrial wheels, and similar parts. The blanks are made by a unique process that combines upsetting, forging, and rolling in one operation. We've got something here. This process gives homogeneity, tough, fibrous structure, and excellent physical properties — an over-all high quality that often makes possible thinner sections.

What's more, the blanks are rough-machined before they leave our plant. It's a step you don't have to figure on in your production schedules.



Rough-machined blanks furnished by Bethlehem are finish-machined in customers' plants. Left, crane-track wheel; above, right, turbine wheel.

Sizes run approximately 10 in. to 44 in. OD. Either carbon or alloy steel may be specified, and your order can be furnished treated or untreated.

Booklet 216 shows many details of these products and their uses. Write for a free copy . . . it's something you'll want to keep.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
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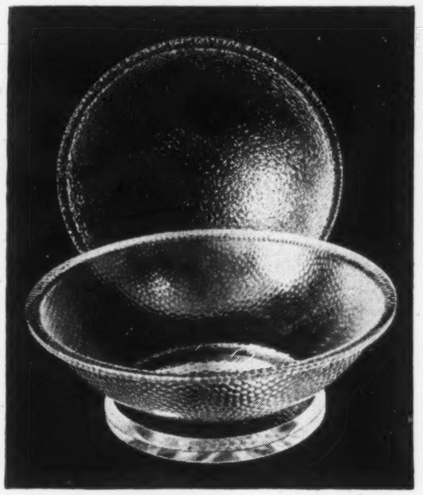
BETHLEHEM ROLLED-AND-FORGED CIRCULAR PRODUCTS

News about Du Pont Plastics

NEW! Phosphorescent "Lucite"

glows in the dark up to 12 hours after exposure to ordinary light. Phosphorescent "Lucite" comes in sheeting only slightly higher in cost than the regular types and has all the excellent properties of standard "Lucite." It's shatter-resistant... easily machined... has rugged endurance outdoors. Uses: advertising and directional signs, light switches and exit signs, dial faces for instruments, radio and telephone sets.



NEW! Patterned "Lucite"

acrylic resin gives designers new opportunities for creating more salable plastic products. It is supplied in a variety of frosted, pebbled and other surface finishes. Patterned "Lucite" has the same properties as the smooth-finished "Lucite"—including resistance to shattering and weathering, strength and light weight. Salad, fruit and flower bowls, trays, cigarette and candy boxes, lamp bases and many other items made of patterned "Lucite" are already in commercial production. In addition, the material offers a new avenue for design and application in the decorative, display and architectural fields.

NEW! Production Facilities

now under construction at Washington, West Virginia, will supplement Du Pont plastics production at Arlington, N. J. This will be a large new plant for producing Du Pont nylon, polythene, and "Lucite" acrylic resin—assuring the continued expansion of the wide range of products made from Du Pont plastics.

For thrilling entertainment, tune in Du Pont "Cavalcade of America"—Mondays, 8 P. M. EST, NBC.

NEW! Price Reductions

of Du Pont plastics! In line with Du Pont's standard policy of lowering prices as production economies permit, three types of "Lucite" molding powder are reduced from 85¢ to 70¢ a pound, and three others from 85¢ to 65¢ a pound in 2000-lb. lots. And although demand still exceeds supply, prices of Du Pont polythene have been reduced for the fourth time since 1943.

DU PONT
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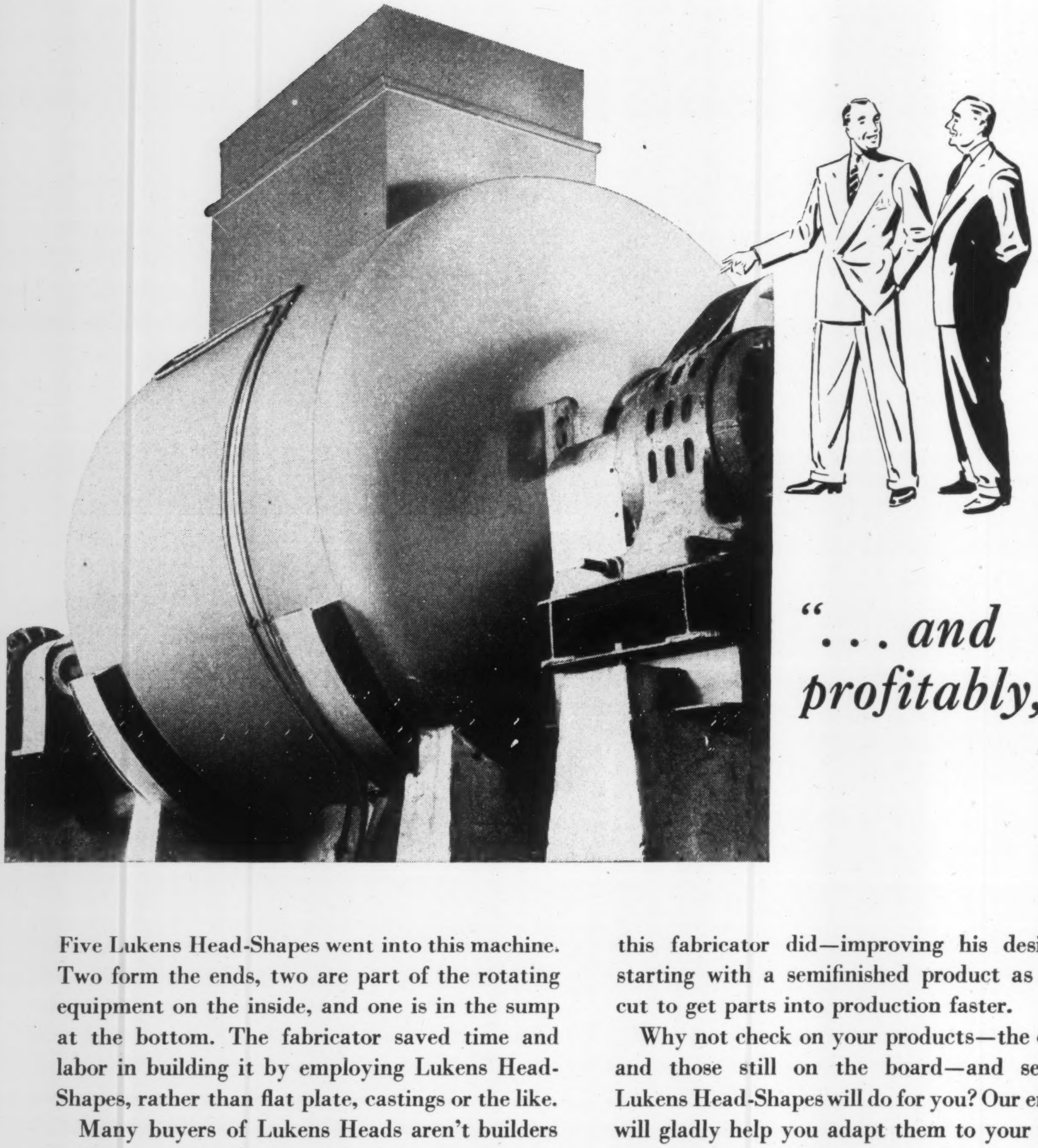
Plastics
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Need sales stimulation? Be sure to investigate the possibilities of Du Pont plastics. They have added new usefulness, new beauty, and increased salability to hundreds of products. Write for booklet today: E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 3910 Arlington, N. J.

"That's using your heads", said a Lukens customer



"... and profitably, too!"

Five Lukens Head-Shapes went into this machine. Two form the ends, two are part of the rotating equipment on the inside, and one is in the sump at the bottom. The fabricator saved time and labor in building it by employing Lukens Head-Shapes, rather than flat plate, castings or the like.

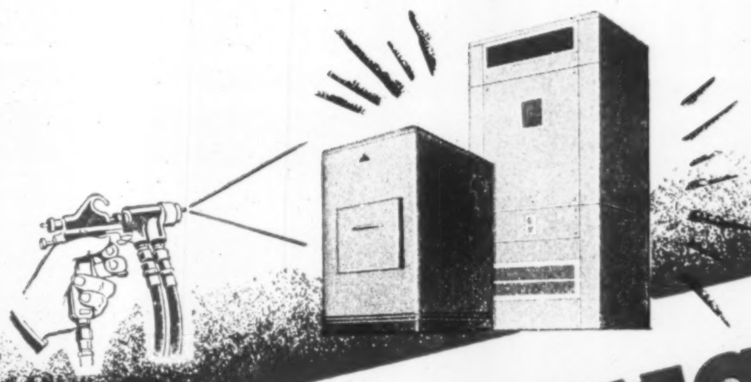
Many buyers of Lukens Heads aren't builders of boilers, tanks or pressure vessels, as you might expect. Instead, they use these head-shapes as this fabricator did—improving his design and starting with a semifinished product as a short cut to get parts into production faster.

Why not check on your products—the old ones and those still on the board—and see what Lukens Head-Shapes will do for you? Our engineers will gladly help you adapt them to your production. Write, describing your problem, to Lukens Steel Company, 418 Lukens Bldg., Coatesville, Pa.

LUKENS

HEADS ★

FOUR INCHES TO OVER EIGHTEEN FEET IN DIAMETER



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2 COLORS
AT ONE OPERATION
⅓ LESS COST

You couldn't ask for anything more! Here's the perfect new finishing material for you. Whatever you make—from Heating and Ventilating Units to Store Fixtures, Radio Equipment—DIMENSO finish on your products will give you beautiful 2-color *hammered* coatings in *one* operation (at *one* baking) at ⅓ less cost.

With patented DIMENSO guns 2 colors of DIMENSO finish can be sprayed simultaneously, on clean bare metal. You can get a smooth, easy-to-clean hammered quality finish with DIMENSO...the modern, fast, economical way!

You can register your exclusive DIMENSO finish with Sherwin-Williams. Our representative will gladly call.

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FREE! DIMENSO Finish Booklet... contains actual finish samples . . . full description. Write the Sherwin-Williams Co., Cleveland 1, Ohio.

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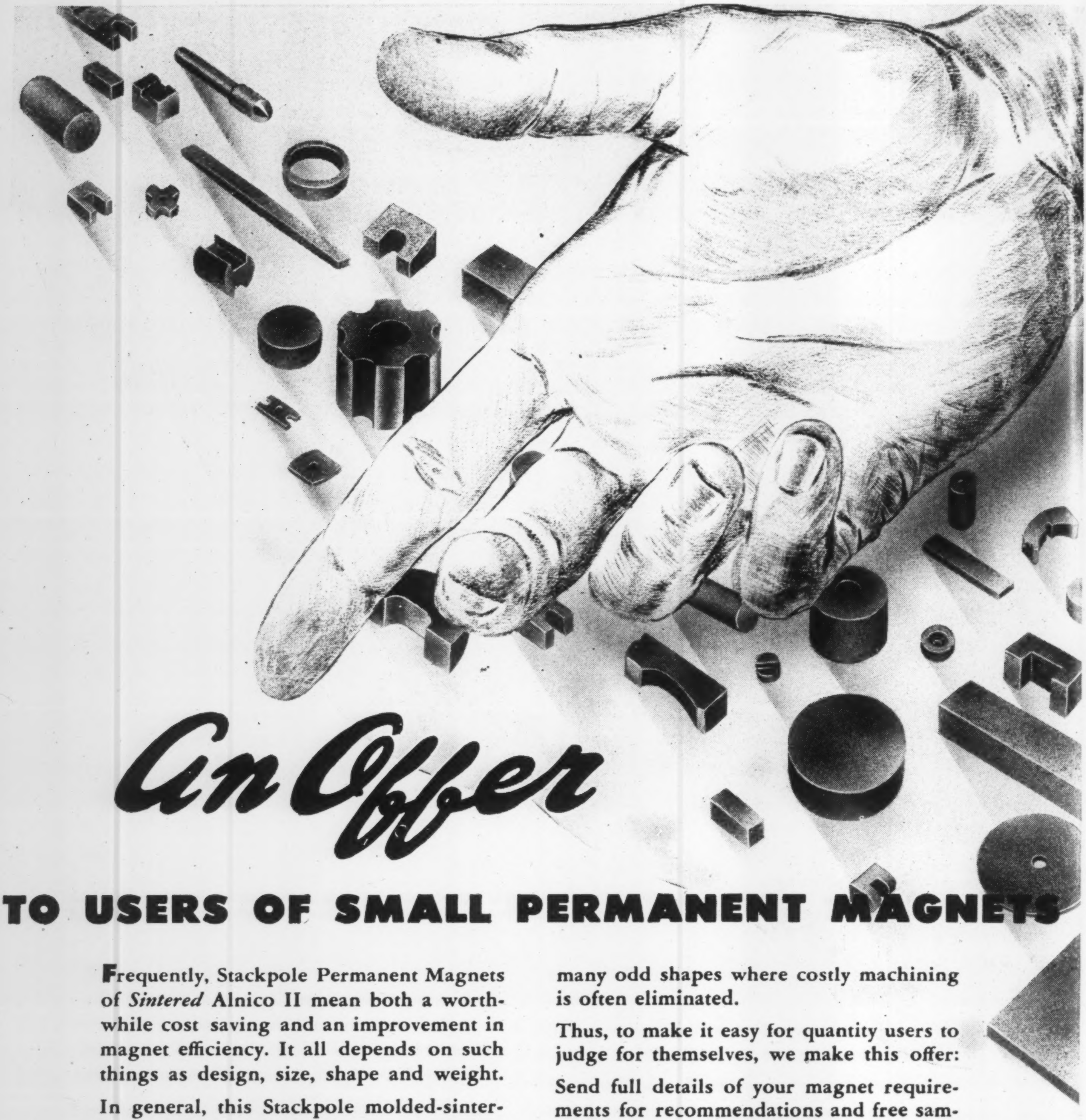

An Offer

TO USERS OF SMALL PERMANENT MAGNETS

Frequently, Stackpole Permanent Magnets of *Sintered* Alnico II mean both a worthwhile cost saving and an improvement in magnet efficiency. It all depends on such things as design, size, shape and weight.

In general, this Stackpole molded-sintering process offers its greatest economies in magnets up to 2 ounces in weight. Besides the production of rectangular and cylindrical types, the method extends to many odd shapes where costly machining is often eliminated.

Thus, to make it easy for quantity users to judge for themselves, we make this offer:

Send full details of your magnet requirements for recommendations and free samples to specifications (but not heavier than 2 ounces). Your own tests of these actual units will speak more convincingly than any mere claims we might make on their behalf.

STACKPOLE CARBON COMPANY • ST. MARYS, PA.

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SMOOTH SURFACES—for easier brazing or soldering.

CLOSE TOLERANCES—with a minimum of costly grinding.

FINE GRAIN STRUCTURE—for greater mechanical strength.

REAL ECONOMY, HIGHER UNIFORMITY—for odd shapes and small sizes.

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Two Remarkable New Aluminum Casting Alloys

DESTINED TO PLAY STAR ROLES IN PRODUCT DESIGN

	MINIMUM	TYPICAL
Tensile strength, p.s.i.	50,000	55,000-60,000
Yield strength, p.s.i.	28,000	32,000-35,000
Elongation, 2"	16%	20% - 30%

ACME *Almag 55*

For the first time in aluminum history, Acme makes available aluminum castings with tensile strength in the 50,000-60,000 p.s.i. range.

This remarkable new alloy is Acme *ALMAG 55*, named for its aluminum and magnesium content. In addition to its great strength, it has unusually high elongation, impact resistance, and corrosion resistance. It machines well and has a beautiful, silver-like appearance that can be given a lasting polish or anodized, dyed or painted.

Due to its high guaranteed properties, Acme *ALMAG 55* can be considered for a wide range of applications including many in which cast and malleable iron and other heavy metals are now specified. Furthermore, Acme controlled casting and heat-treat techniques, lighter weight, and reduction in machining time combine to produce a favorable cost analysis.

• •

	MINIMUM	TYPICAL
Tensile strength, p.s.i.	33,000	38,000-41,000
Yield strength, p.s.i.	15,000	18,000-21,000
Elongation, 2"	7%	10% - 15%

ACME *Almag 35*

Now you can obtain high strength aluminum castings *as cast*. Acme *ALMAG 35* offers maximum physical properties greater than aluminum alloys containing copper, zinc, or silicon even after these other alloys have been heat treated. This new Acme alloy is characterized by high corrosion resistance, 33,000 to 41,000 p.s.i. tensile strength (as cast), excellent ductility, and good machinability.

Generally speaking, Acme *ALMAG 35* offers the same advantages as the best previously available aluminum casting alloys . . . with the elimination of heat treatment. This is of unusual importance where heat-treat facilities are not available or where cost is an important factor. Furthermore, Acme *ALMAG 35* can be cast by sand, die, plaster, or permanent mold processes.

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ACME SERVICES: *aluminum, brass, bronze castings . . . aluminum casting alloys . . . patterns . . . tools . . . engineering . . . rare chemicals and rare metals . . . special specification alloys in wire or ingots*

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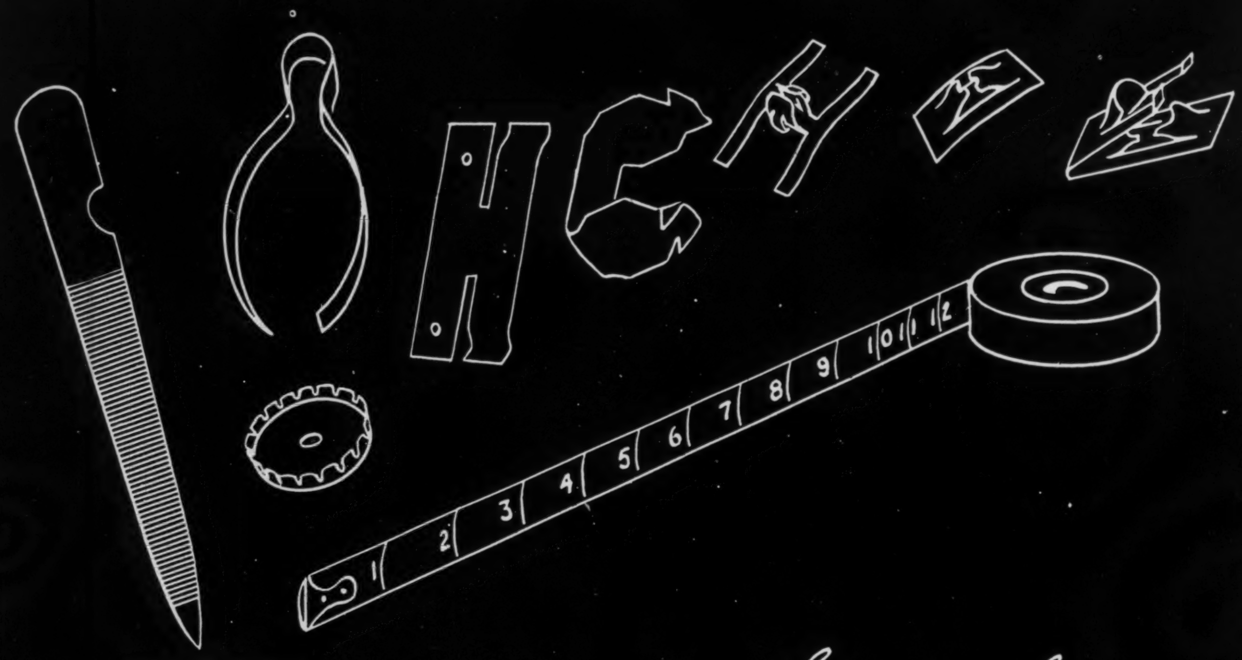

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...brings plus qualities to product and production

● In their critical search for the means of achieving higher product quality and greater production efficiency, more and more users of high carbon steel are turning to CMP Carbon and Alloy Spring Steel. If yours is a problem of product, production or profit you would do well to check the advantages of this precision material.

Because of its precision characteristics and consistent results CMP Spring Steel offers important plus qualities to both your production operations and your end product.

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- Width and gauge are accurate to closest tolerances.
- Chemistry is held within proper range for best heat treatment response.
- Annealing is controlled for the ideal spheroidization.
- Decarburization is held to the absolute minimum.
- Physicals are uniform throughout every shipment.

Chances are we can help in your spring steel problems. . . . Write, wire or call.

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UNITED STATES RUBBER COMPANY
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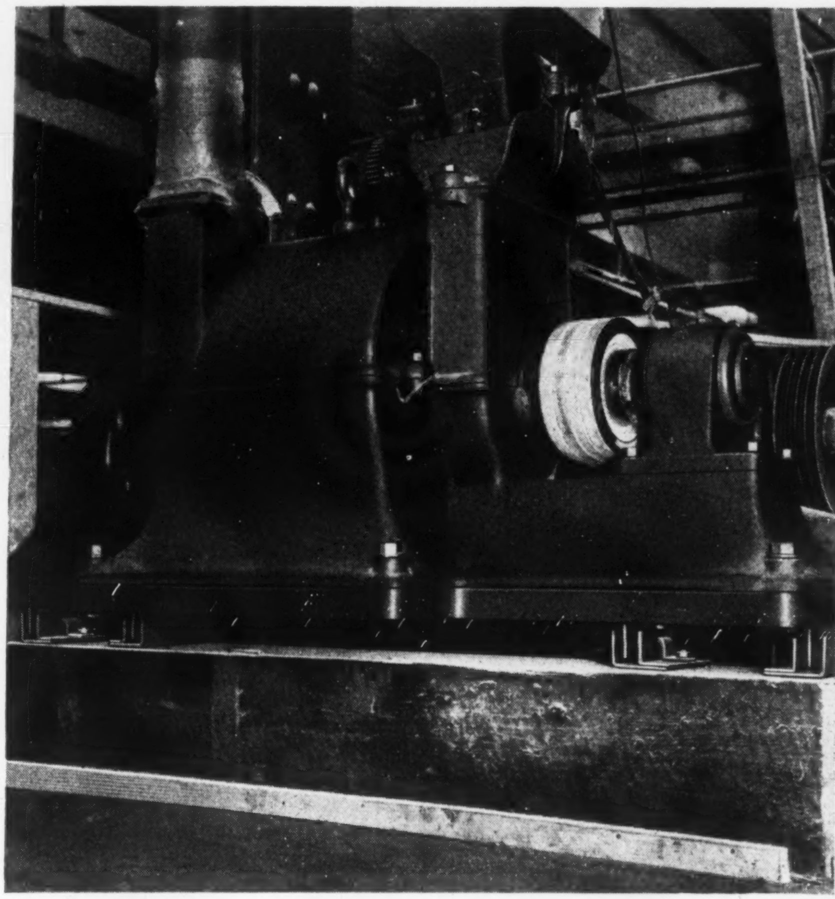
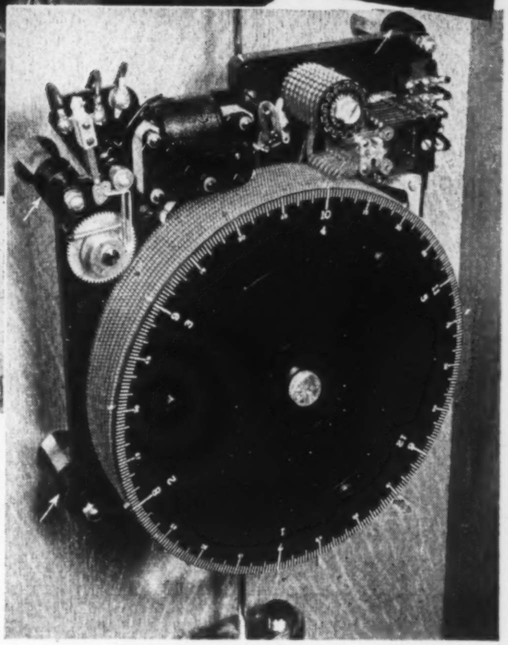
An Engineering Service for Designers who have Noise or Vibration Problems



"The whole building shakes," said officials of a sugar plant. Their 5400-lb. sugar pulverizer ran very noisily, and transmitted nerve-wracking and dangerous vibration throughout the building. Then United States Rubber Company engineers recommended installing the motor and the pulverizer on a steel base plate, which in turn was "floated" on seven U. S. Engineered Rubber Mountings. Result? Machine ran more quietly, and transmission of vibration ceased.



"Vibration can make our machine useless," stated the makers of a modern Precision Timing Device. To eliminate the possibility of damage by external vibration to this delicate instrument, United States Rubber Company engineers cushioned it with four cylindrical type engineered rubber mountings of scientifically compounded rubber permanently bonded to metal studs. The operation was 100% successful.

THE effects of vibration, impact and transmitted noise can very often be eliminated by engineers of United States Rubber Company. They welcome the opportunity to help you on such problems . . . whether your product is big or small, in the planning stage or already completed. Chances are these experts on engineered rubber mountings have already solved a problem similar to yours.

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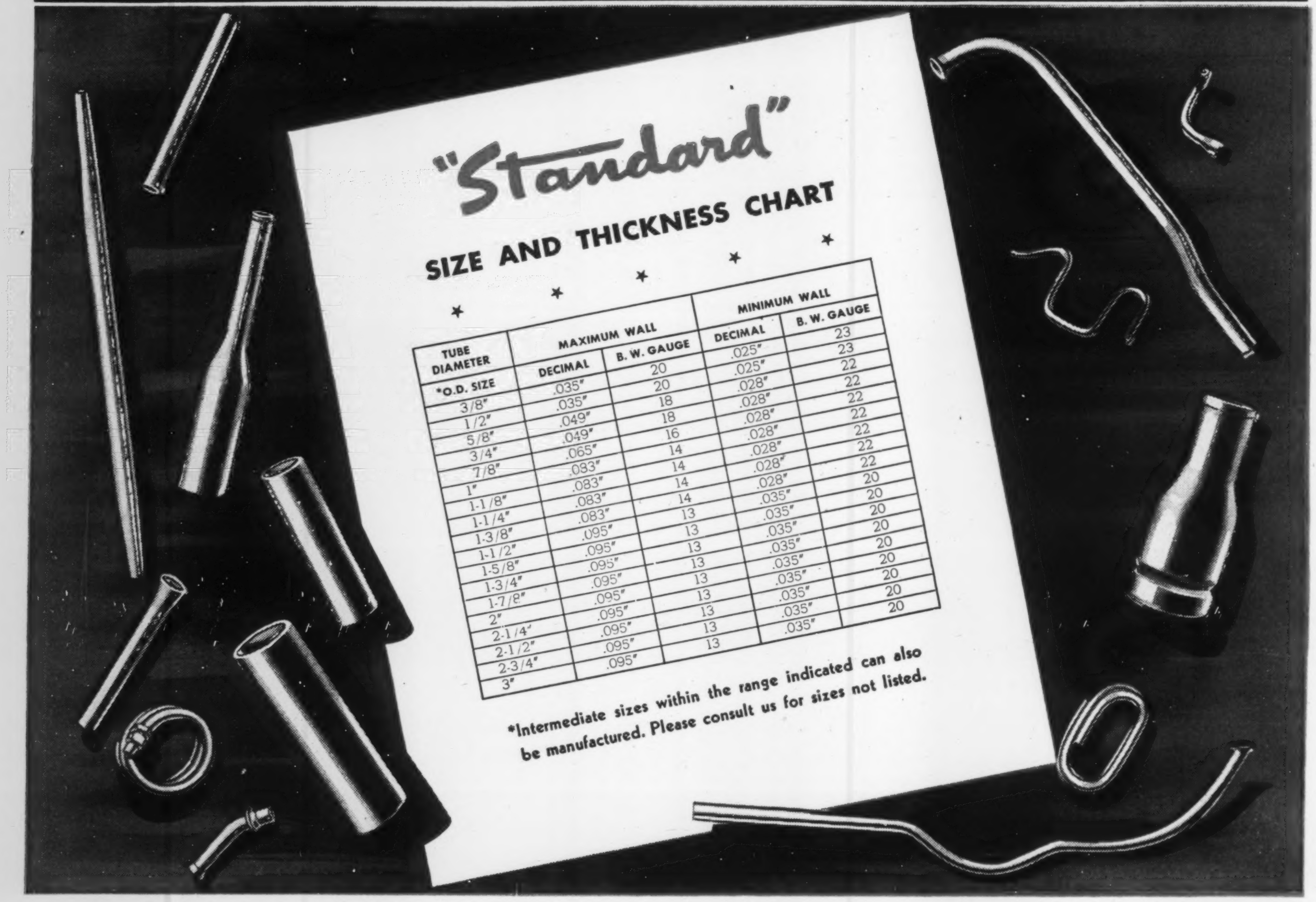
NOW AVAILABLE "Standard" WELDED STAINLESS STEEL TUBING



"Standard"

SIZE AND THICKNESS CHART

★ ★ ★ ★ ★

TUBE DIAMETER	MAXIMUM WALL		MINIMUM WALL	
*O.D. SIZE	DECIMAL	B. W. GAUGE	DECIMAL	B. W. GAUGE
3/8"	.035"	20	.025"	23
1/2"	.035"	20	.025"	23
5/8"	.049"	18	.028"	22
3/4"	.049"	18	.028"	22
7/8"	.065"	16	.028"	22
1"	.083"	14	.028"	22
1-1/8"	.083"	14	.028"	22
1-1/4"	.083"	14	.028"	22
1-3/8"	.083"	14	.028"	22
1-1/2"	.095"	13	.035"	20
1-5/8"	.095"	13	.035"	20
1-3/4"	.095"	13	.035"	20
1-7/8"	.095"	13	.035"	20
2"	.095"	13	.035"	20
2-1/4"	.095"	13	.035"	20
2-1/2"	.095"	13	.035"	20
2-3/4"	.095"	13	.035"	20
3"	.095"	13	.035"	20

*Intermediate sizes within the range indicated can also be manufactured. Please consult us for sizes not listed.

Many Analyses for Numerous Applications

With more than a quarter of a century experience in the manufacture of Welded Carbon Steel Tubing, we have now added to our line, "Standard" Stainless Steel Tubing produced by the atomic Hydrogen Welded process.

"Standard" Stainless Steel Tubing can be furnished in the various analyses such as Type 302 - 304 - 316 - and 347.

"Standard" Stainless Steel Tubing is available for Mechanical, Pressure, Structural and Ornamental applications. Specify "Standard" and get the best.

STANDARDIZE WITH "STANDARD"—IT PAYS

THE STANDARD TUBE CO.
Detroit 3, STANDARD Michigan
Welded Tubing Fabricated Parts
STANDARDIZE with "STANDARD"—It Pays

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★ *Complete Tube Stocks Maintained by* ★
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LAPHAM-HICKEY COMPANY, 3333 W. 47th Place, Chicago 32, Ill.
UNION HARDWARE & METAL CO., 411 E. First St., Los Angeles 54, Cal.
THE PACIFIC PIPE COMPANY, 160 Spear St., San Francisco 5, Cal.
METAL GOODS CORPORATION, 1300 Burlington, North Kansas City, Mo.

Do these false beliefs keep you from converting to aluminum?

(Below are 4 *misstatements* commonly applied to aluminum. Have *you* made any of them?)

1. "Aluminum is not readily adaptable to my product"

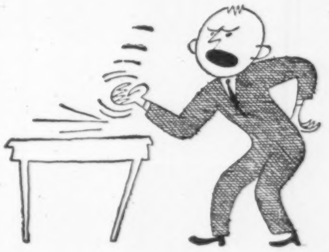
Fact: Kaiser Aluminum comes in a wide range of alloys to meet every type of manufacturing operation, and can be formed, drawn, spun, brazed or joined. It can be painted or polished, or finished in almost any way you choose. To select the alloy specifically suited to your requirements, simply call on a Permanente Metals' engineer.

2. "Aluminum costs too much"

Fact: While prices of other materials have steadily risen, aluminum is now *at the lowest price in history.* Figured *not* on a per pound basis, but on *unit cost,* aluminum prices (which include freight charges) compare favorably with those of any other metal or material. In addition, savings made on handling, finishing and shipping cut costs substantially.

3. "My competitors aren't converting. Why should I?"

Fact: Scores of manufacturers are speeding their products to market—by converting to aluminum. That's true of makers of general appliances, residential buildings, air conditioning units, heating and ventilating ducts, garage doors and window frames, office appliances and cabinets . . . *plus dozens more.* Their experience can help *you.*



4. "I can't be sure of a steady, long-term supply"

Fact: This is *especially* wrong *today.* For Permanente Metals now offers you a new source of aluminum . . . Kaiser Aluminum. In but a single year of operation Permanente Metals' mammoth aluminum plants produced 175 million pounds of plate, sheet, and strip aluminum. Almost as much as the entire industry produced in the most productive year before the war.

To the above facts add these . . .

Aluminum's resistance to corrosion cannot be matched. Nor can its strength per pound—it can give you the strength of steel at one-third the weight.

Aluminum's appearance can put an extra sparkle of *saleability* on many products, giving them a competitive edge.

In the light of all these *facts,* can you afford NOT to investigate the possibility of converting to aluminum? Call any Permanente Metals' office and an experienced sales engineer will be on the job, for *you!*

Ready to serve you—today... Kaiser Aluminum

a Permanente Metals product

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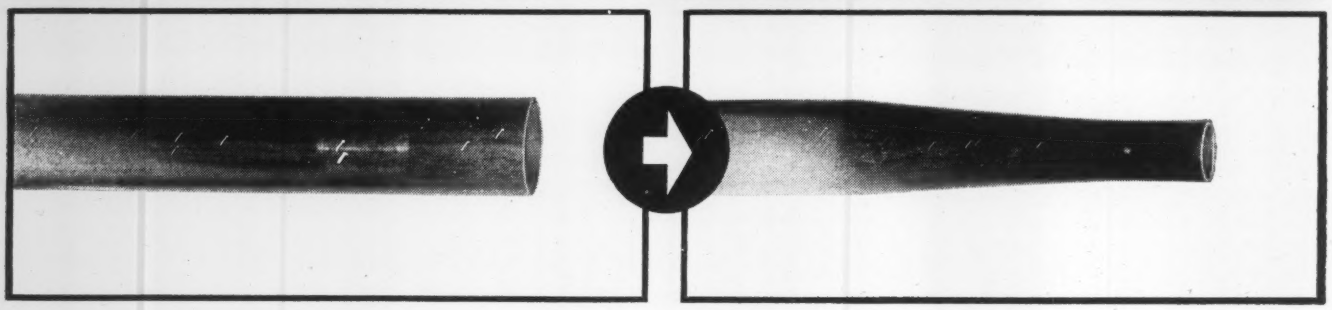
In Answer to Your Advertisement!

HELP WANTED

Skilled craftsmen, capable of forming and fabricating seamless and welded steel tubing to exact specifications. Must supply own equipment, be able to follow blueprint instructions and provide prompt delivery of finished work that will pass rigid inspection at our plant. Address Box 1947.



THE SKILLED CRAFTSMEN and necessary production equipment required to form and fabricate OSTUCO quality seamless and welded steel tubing are available now. Production-wise management men in hundreds of industries have learned that OSTUCO's skilled craftsmen and OSTUCO Steel Tubing can provide short cuts in production that mean a real savings in cost.

Swaging, the operation pictured above, is just one of many forming and fabricating operations The Ohio Seamless Tube Company is prepared to handle for you. Your product may be built better, at lower cost, through the use of OSTUCO facilities and tubing. The nearest sales engineer will gladly point out the economies in time, money and manpower to be effected through OSTUCO services.

Complete information is available, without any obligation, at the sales office nearest you. Phone or write today.

SHELBY OSTUCO OHIO

THE OHIO SEAMLESS TUBE COMPANY

***Plant and General Offices:* SHELBY, OHIO**

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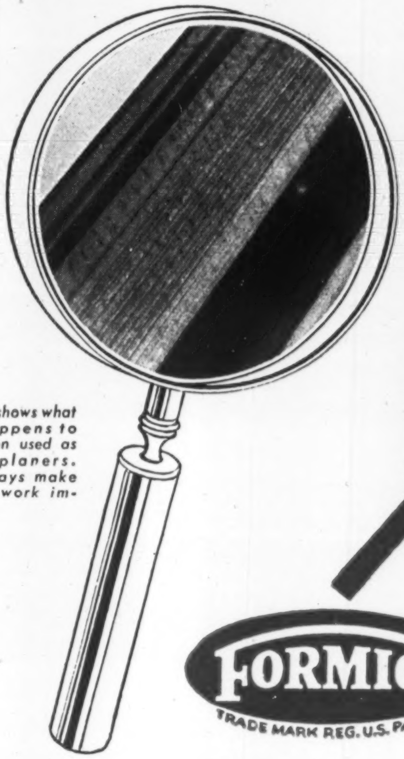
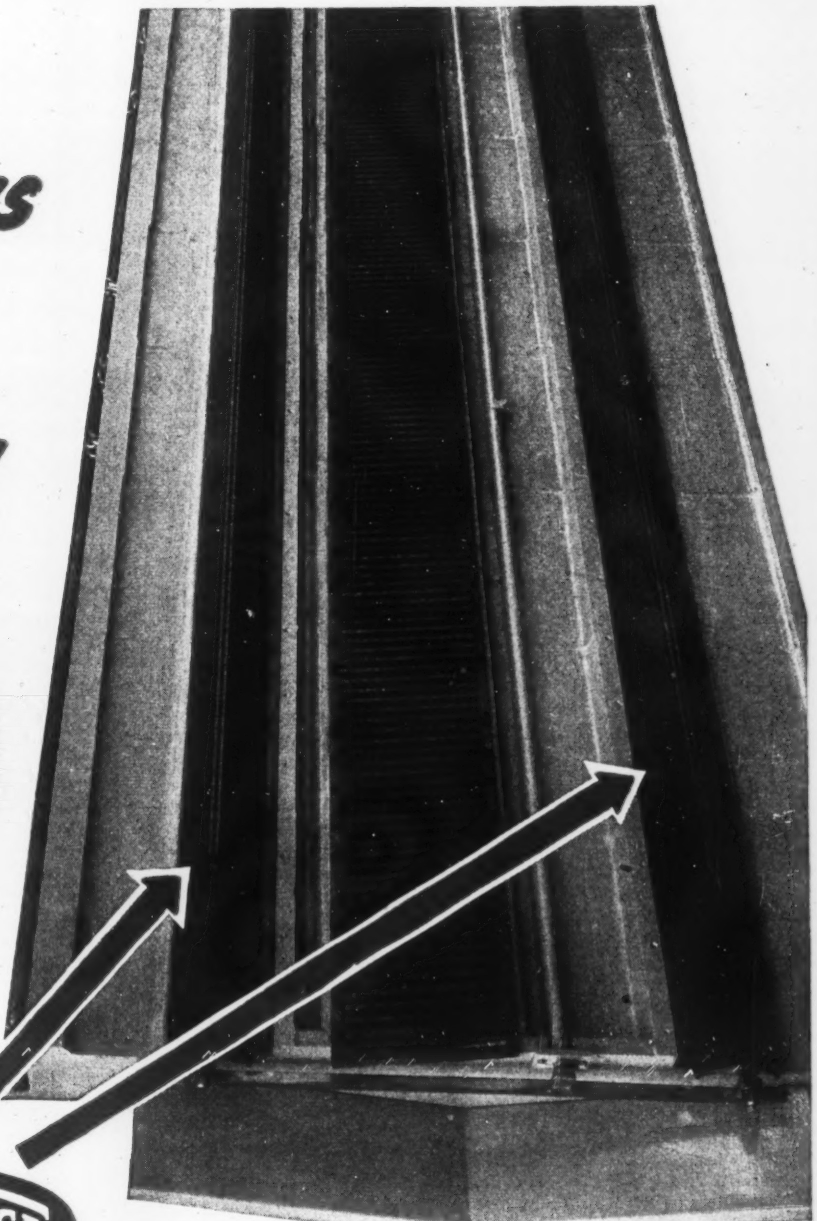
Formica Ways Don't Score or Overheat!



The photo shows what often happens to metal when used as ways on planers. Scored ways make accurate work impossible.



FORMICA

TRADE MARK REG. U.S. PAT. OFF.

FORMICA ways on planer tables have proved their ability to support very heavy loads traveling at high speeds without creating heat that would warp the table, and maintaining a smooth even surface with no scoring. That means accurate work by the planer over a long life.

In fact the use of Formica for these bearing surfaces is one of the most significant advances in planer design during the past quarter century. It was developed by the G. A. Gray Company, Cincinnati.

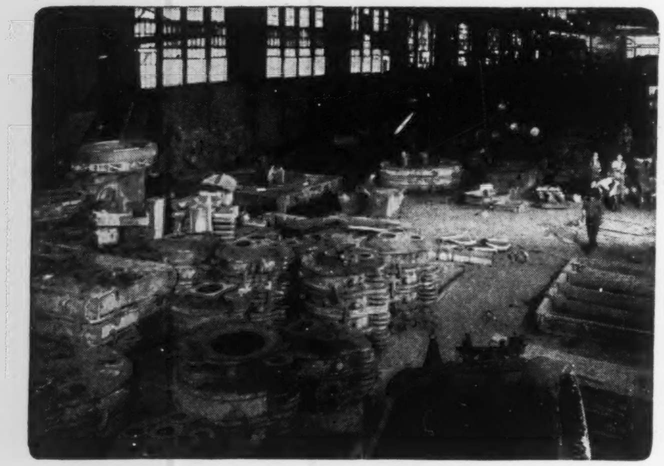
Previously scored table ways, and warped tables, often threw planers out of line and made real accuracy impossible. But removing and renewing the table was such a difficult and cumbersome operation that planer users often went on for years struggling with an inefficient tool rather than take time out to put it back in shape.

Now Formica ways, properly lubricated with oil have solved the problem. The very first planer so equipped is still in perfect condition doing perfect work.

For many bearing surfaces where pressures are high Formica provides the answer.

THE FORMICA INSULATION CO., 4648 SPRING GROVE AVE., CINCINNATI 32, O.

NELOY *Steel Castings* AND *Cut Gears* IN INDUSTRY



NELOY (or NELOY MOLY) by performance in its broad range of uses has become the synonym for the Ideal Alloy Steel . . . possessing machineability, toughness, strength, hardness and resistance to shock and wear. Where these qualities are demanded in the design and production of industrial machinery, metallurgists and designing engineers agree on Neloy (or Neloy Moly) castings as first choice.

Here are the qualities of Neloy (or Neloy Moly) flame hardening:

1. No sharp line of demarcation between case and core . . . no quick change in chemical analysis as characteristic of ordinary case hardened material.
2. The surface material depends not on hardness alone, but combines high hardness & toughness to resist wear and impact.
3. A core value that is equal to that of alloy steel, offering fatigue or impact values much higher than the regular case hardened product.
4. Hardened depth for necessary wear resistance equal to case hardening treatment at about ⅓ the cost.
5. A surface that will not spall with vibration or impact.

Write for Bulletin No. 7.

COMPARISON OF THE PHYSICAL PROPERTIES FOR NELOY AND NELOY-MOLYBDENUM STEELS

	ULTIMATE TENSILE LBS. SQ. IN.	ELASTIC LIMIT OR YIELD POINT LBS. SQ. IN.	ELONGATION PERCENT	REDUCTION OF AREA PERCENT	BRINELL	SCLEROSCOPE
Neloy, Annealed	75/ 85,000	50/ 60,000	20—30	30—40	156—163	23—23
Neloy-Molybdenum, Annealed	85/ 95,000	45/ 85,000	20—25	30—40	170—197	24—30
Neloy No. 1, Normalized	85/ 90,000	55/ 65,000	23—30	30—40	163—170	23—24
Neloy-Molybdenum, Normalized & Drawn	90/110,000	65/ 85,000	18—25	30—40	190—220	28—33
Neloy No. 2, Normalized & Drawn	90/ 93,000	65/ 75,000	23—28	35—45	174—198	24—28
Neloy-Molybdenum No. 2-A	100/115,000	70/ 90,000	15—20	35—45	207—229	28—35
*Neloy No. 3	100/110,000	80/ 90,000	20—26	40—50	202—240	29—33
*Neloy-Molybdenum No. 3-A	125/140,000	115/130,000	12—15	30—40	250—280	38—41
*Neloy No. 4	115/130,000	95/110,000	15—20	35—45	240—268	33—37
*Neloy No. 5	125/135,000	110/125,000	12—20	30—40	268—288	37—40
*Neloy-Molybdenum No. 5-A	140/160,000	130/145,000	10—12½	20—30	302—331	47—50
*Neloy No. 6 †	135/150,000	120/135,000	9—18	30—40	286—302	40—42
*Neloy-Molybdenum No. 6-A†	160/180,000	145/160,000	7½—10	15—25	341—375	52—57
*Neloy Heat-Treatment No. 7†	145/165,000	135/155,000	12—20	35—55	264—302	36—42
*Neloy Heat-Treatment No. 8†	165/190,000	155/175,000	8—14	30—45	302—264	42—51
*Neloy Heat-Treatment No. 9†	190/220,000	175/195,000	8—14	25—45	364—477	51—66
*Neloy Heat-Treatment No. 10-A†‡	190/220,000	175/195,000	8—14	25—45	364—477	51—66
*Neloy Heat-Treatment No. 10-B†‡	218/270,000	190/240,000	8—12	20—35	477—590	66—80

*These Steels are liquid quenched and drawn. The maximum size piece to be quenched should not exceed 6 ft. x 6 ft. x 3 ft.

†These are fully hardened and no machining can be done after heat-treating. Seven classes of physical values are listed, as we recommend values comparable to the size of the gear tooth so that uniformity of toughness will be obtained from the surface to center of the tooth.

‡Physical properties of outer fibers. (Core properties depending on previous treatment.

Treatment No. 7—Small pitch gears up to and including 5 DP. *Treatment Nos. 8 and 10-A—Medium pitch gears up to and including 3½ DP.* *Treatment Nos. 9 and 10-B—All gears over 3½ DP, up to and including ½ DP, or 6-inch CP.* *Treatment No. 10-A—For cast tooth gears, any pitch.*

NATIONAL ERIE CORPORATION

ERIE, PENNSYLVANIA • U. S. A.

WOLVERINE TRUFIN

Cools The Air In The New Luminaire*

Again, Wolverine Trufin, THE integral finned tube, demonstrates its pronounced versatility! In this instance it forms a substantial part in a unique appliance — the Luminaire Conditioner. Formed into a coil, Trufin serves as the evaporator for the unit for cooling and dehumidifying the air.

The compact, efficient unit employs THE integral finned tubing, having 7 fins to the inch. Mounted atop the fixture surrounding triple fluorescent lights, the Wolverine Trufin coil has 61 square feet of outside surface.

*Luminaire is the trade name of the Parlong Air Conditioning Corporation's Air Conditioner. It emulates the function of the larger industrial types of air-conditioner, and in addition serves as an attractive lighting fixture and a germ killer.

Wolverine Trufin — THE integral finned tube — increases surface area over plain tube nearly four times and can be fabricated as readily as plain tube. You can enjoy dependable efficiency together with savings in space and labor costs by using Wolverine Trufin. It is available in a variety of fin spacings, heights and alloys.

We'll be glad to send you Engineering Pamphlets on the correlation of data on heat transfer through use of finned tube. Ask for them on your stationery.

WOLVERINE TUBE DIVISION

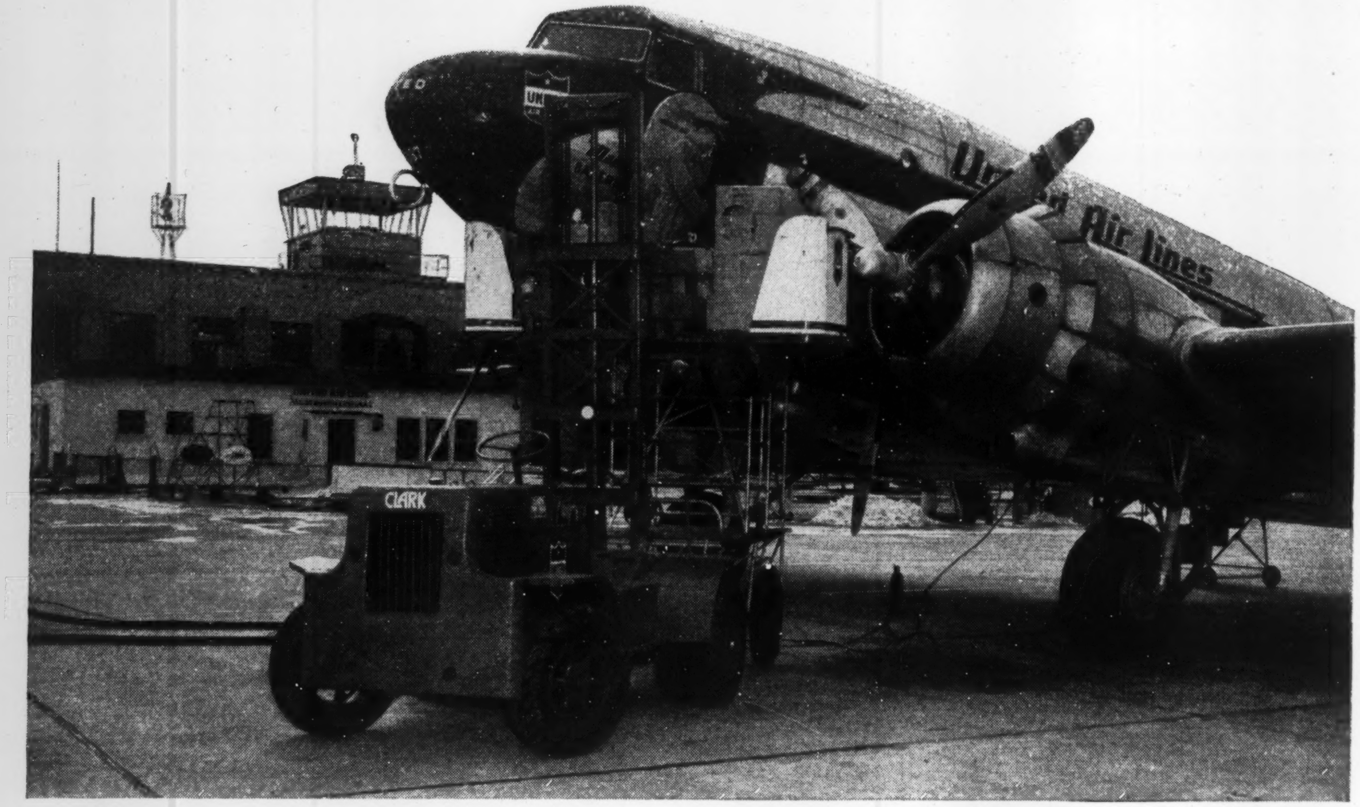
CALUMET & HECLA CONSOLIDATED COPPER COMPANY

MANUFACTURERS OF SEAMLESS COPPER & BRASS TUBING

1411 CENTRAL AVENUE • DETROIT 9, MICHIGAN

CLARK TRUCKTRACTORS get a lift—

from Fiberglas* Electrical Insulation



Dependability in tough service is a requirement for Clark Trucktractors, indoors or out. To assure such service, Fiberglas insulated motors are used in these sturdy materials handling units.

Because Fiberglas insulation withstands the conditions which most frequently cause motor burnouts, it is being used to provide an extra margin of safety in many types of equipment.

Wherever heat, moisture, corrosive vapors or acids may be encountered by electrical equipment of any kind, specify Fiberglas Electrical Insulating Materials and be sure of more efficient operation at lower cost.

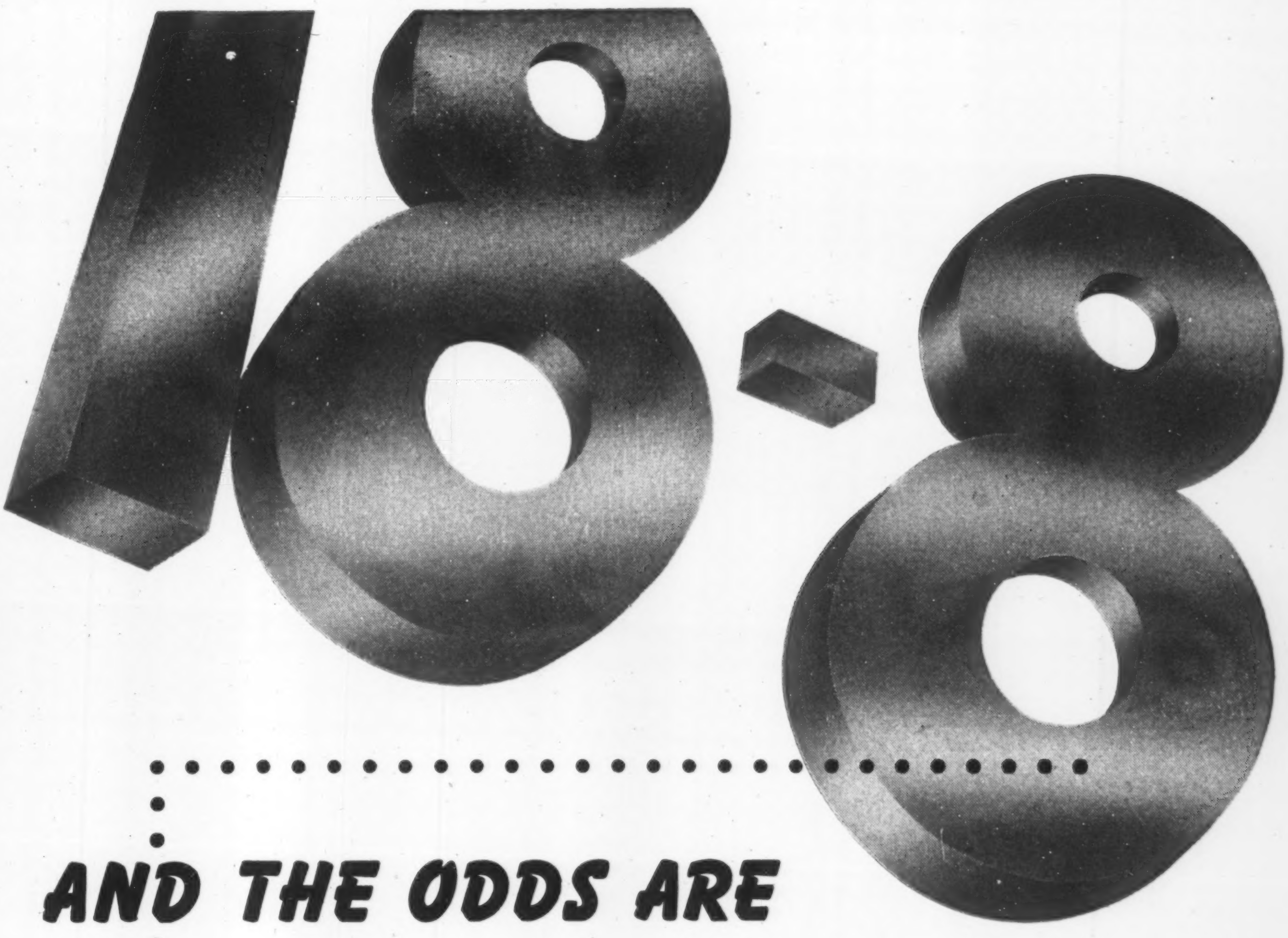
Fiberglas Electrical Insulating Materials are available in forms to meet practically every insulation need. If you are concerned with the design, manufacture, use or maintenance of electrical equipment, get all the facts about Fiberglas Electrical Insulations. Write for catalog EL 46-11. Owens-Corning Fiberglas Corporation, Dept. 808 Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

OWENS-CORNING
FIBERGLAS
T.M. REG. U.S. PAT. OFF.

ELECTRICAL
INSULATING
MATERIALS

***Fiberglas is the trade mark (Reg. U. S. Pat. Off.) for a variety of products made of or with glass fibers by Owens-Corning Fiberglas Corporation.**



AND THE ODDS ARE

3 TO 1

that castings made from one of the famous Circle Ⓛ "18 and 8" alloys will do a better and more practical job in resisting corrosive conditions than those made from any other formula.

We pour a lot of alloy tonnage out of our electric induction furnaces in the course of a month. Some of it is very special stuff. All of it is carefully matched to the exact service conditions of the equipment and machinery into which the castings are fabricated. A study of our records proves beyond a doubt that our Circle Ⓛ "family" of "18 and 8" alloys tops the list as the practical, economical corrosion resistant material.

The Nominal Analysis and Nominal Physical Properties of one of these, Circle Ⓛ 22, are given at left. However there are many variants of this approximate analysis which make possible its successful application to a wide range of service conditions. They are summarized on the new Circle Ⓛ Alloy Data Sheet, sent upon request.

LEBANON CIRCLE Ⓛ 22

NOMINAL ANALYSIS

Carbon Max.	0.07
Silicon	1.25
Manganese	0.75
Chromium	19.50
Nickel	9.00

NOMINAL PHYSICAL PROPERTIES

Tensile Strength	75,000
Yield Point	36,000
Elongation in 2"—%	50
Brinell Hardness	135

LEBANON STEEL FOUNDRY • LEBANON, PA.

"In The Lebanon Valley"

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

Lebanon CIRCLE L **ALLOY AND STEEL** **Castings**

BUILD *OVERLOAD PROTECTION* INTO ELECTRICAL EQUIPMENT

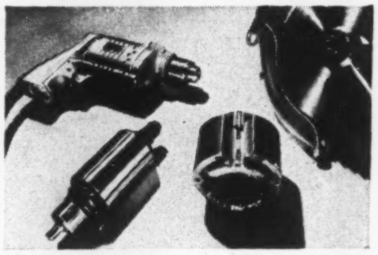
...with MICA INSULATION

Because electric apparatus is frequently operated by the user beyond normal capacity, dependable insulation is an excellent safeguard against failure caused by temporary overloads. Failure from burnout, motor repairs or replacement and customer dissatisfaction can be relieved through proper insulation.

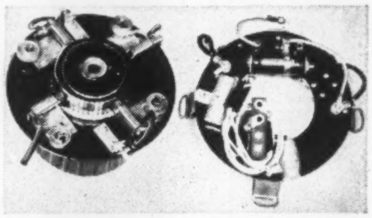
For instance, overload protection is often built into quality components for motors of all types by the use of built-up Mica segment plates for commutator insulation. Micanite's physical properties enable commutators to withstand centrifugal forces and high ambient temperatures.

Micanite enables designers of electric equipment to meet higher temperature requirements. Micanite combines the advantages of pure mica with economy since it can be readily molded, cut or stamped for different product requirements. Micanite consists of thin mica splittings bonded together into sheets or tubes; available as segment plate, molding plate, flexible plate, heater plate, or composite sheets or wrappings with varied properties.

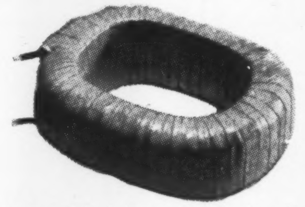
Insist upon Micanite, or other time-proved insulation materials made by Mica Insulator Company for specific applications or purposes, to maintain performance and brand acceptance.



Micanite commutator segments are used for insulating motor parts for portable electric tools.



Micanite commutator rings and segments and Lamicoid brush rings serve for insulation in electric generators.



Empire varnished bias-cut tape lies flat on curved portions of this coil assuring good insulation.

MICA *Insulator* COMPANY

Schenectady 1, New York

Atlanta • Birmingham • Boston • Chicago • Cincinnati • Cleveland • Detroit • Houston • Los Angeles • New York • Philadelphia
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MADISON-KIPP DIE CASTINGS

Moulding Dies Duplicated Accurately

Die castings are sometimes used as moulds for manufacturing large quantities of non-metallic parts . . . The casting cycle and other factors affecting shrinkage can be closely controlled so that each casting is like the next one—within very close limits . . . The die casting process often offers distinct advantages in price, in weight, in accuracy, and in improving product appearance.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

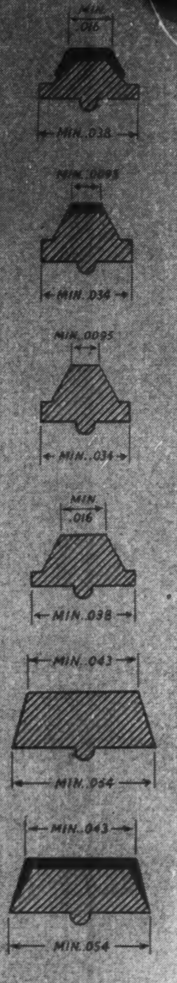
MADISON-KIPP CORPORATION

210 WAUBESA STREET, MADISON 4, WISCONSIN, U. S. A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

Electrical Contact Material for Bar or Disc Contacts



Our contact material is available in bi-metallic form . . . palladium, platinum or silver, pure or alloyed, bonded to nickel or nickel silver . . . or in solid form of any precious metal or alloy.

We are prepared to –

- . . . **supply this material for your own attaching**
- . . . **attach the contact material to arms supplied by you**
- . . . **provide complete assemblies of arms with contact material attached**

Our new bar contacts result in a great saving of precious metals with assured contact area equal to the width of the bar, with larger mislocation tolerances, and with marked economy in attaching. But whether bar or disc, these contacts are permanently welded with a weld strength of 25 to 35 pounds where thickness of blade permits, and they can be positioned within .005 on length and .010 transverse.

The electrical conductivity and life of a welded contact greatly exceeds that of the mechanically applied type because it is fused . . . permanently bonded to the arm, not dependent upon mechanical pressure for electrical contact between arm and contact.

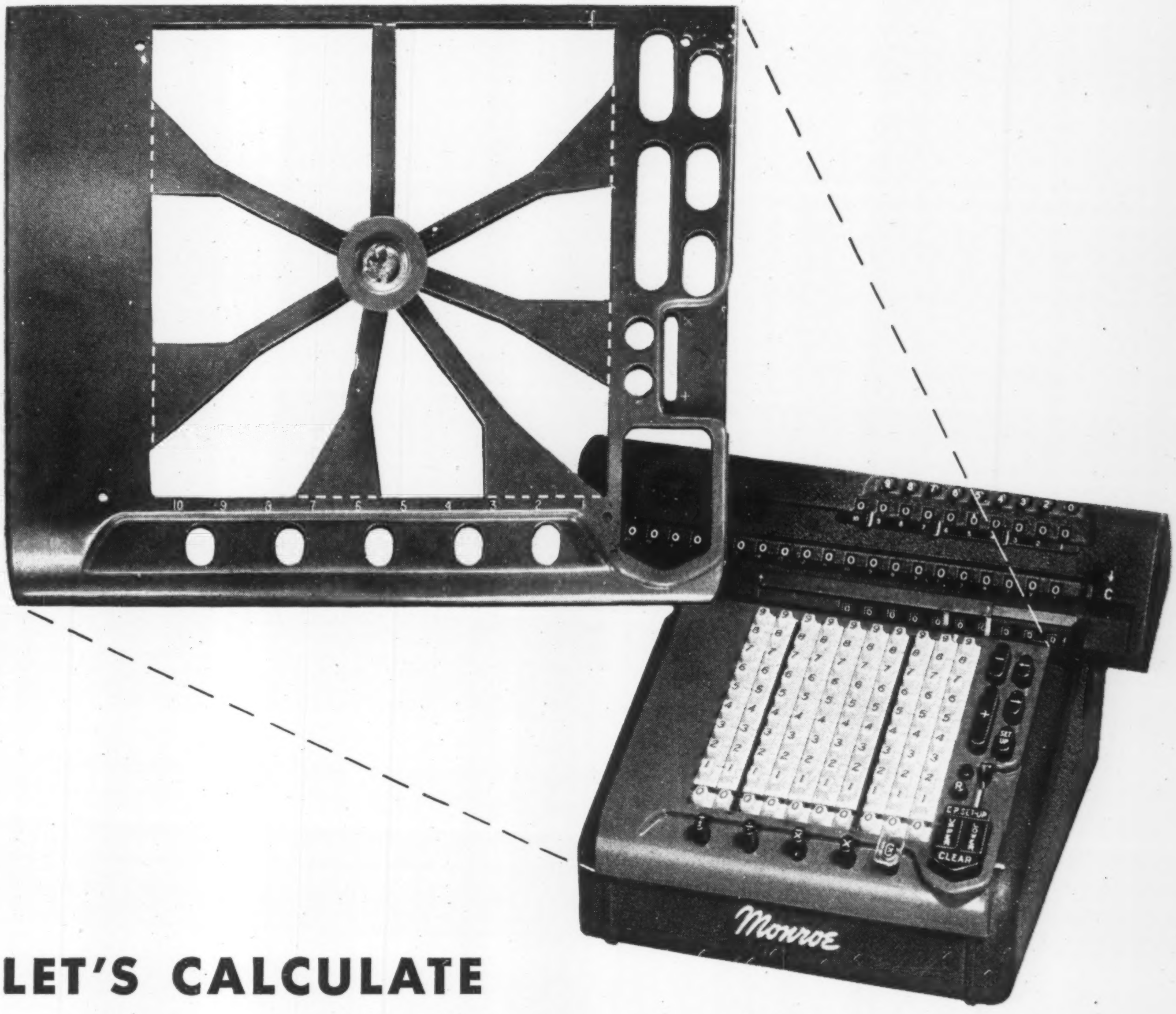
One of our sales engineers will be pleased to assist you in comparing the costs of our materials and methods of application with conventional types.

BAR CONTACT TAPE . . . *under license arrangement with Western Electric Company, Inc.*

START RIGHT with **Makepeace** PRODUCTS

SHEETS • WIRE • TUBING • SOLDERS • FABRICATED PARTS AND ASSEMBLIES OF SOLID AND LAMINATED PRECIOUS METALS

D. E. MAKEPEACE COMPANY
Main Office and Plant, Attleboro, Massachusetts
NEW YORK OFFICE, 30 CHURCH ST.   CHICAGO OFFICE, 55 EAST WASHINGTON ST.



LET'S CALCULATE what one plastic part saved in this CALCULATOR!

You could run up a big total on this Monro-Matic Calculator if you figured the following savings in dollars and cents!

Through use of Bakelite Styrene plastics *at least five steps were avoided* in the manufacture of the keyboard top-plate you see above.

Suppose this part had been stamped or drawn from another material—instead of injection-molded in one simple operation from this versatile Bakelite plastic. First, it would have been blanked out. Then stamped. Then drawn—then pierced—then finished with primer and lacquer topcoat . . . After molding, the Bakelite Styrene plastic part is trimmed of its gates and sprues—nothing else. Even the *color* is an integral component. And trimming follows molding so immediately that the two are considered one operation.

And in totaling up the savings, don't forget to figure in the reduced tool cost and tool maintenance resulting from the ease and simplicity of injection molding!

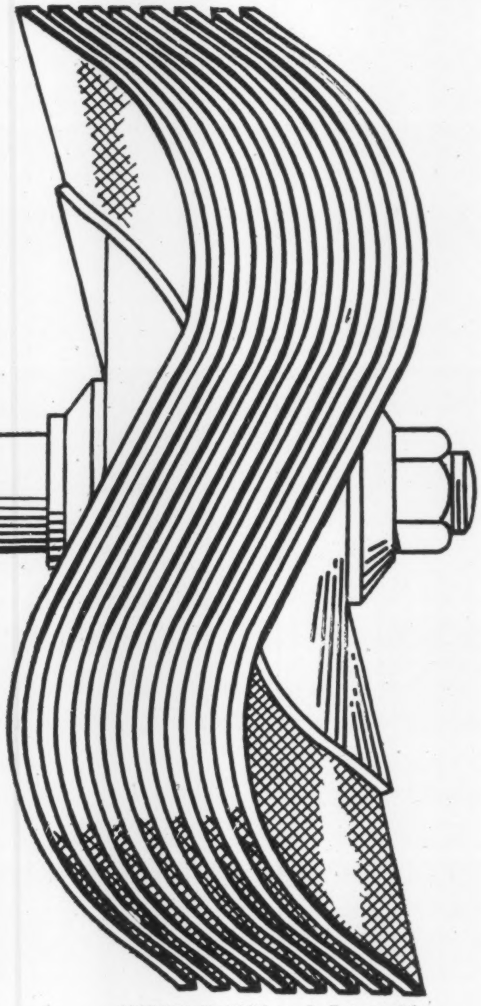
In these days of price and quality competition, one of your most important production questions is, "How can you do it *better*—and cut costs?" Often the answer lies in such a plastic as Bakelite Styrene—with its excellent dimensional stability, lightness in weight, resistance to moisture, chemicals, perspiration, its ease of handling, and other valuable characteristics. Write Department 17 for Booklet G8, featuring Bakelite Styrene and other types of plastics and resins.

BAKELITE
TRADE-MARK
Styrene
PLASTICS

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

NEW H-VW-M Multi-Wave Buff Assembly

for LONG WEAR
LOW INITIAL COST
HIGH EFFICIENCY



H-VW-M Multi-Wave Buff Assembly
Covered by
U.S. Pat. No. 2384599

Get greater flexibility in cutting down and coloring operations through the unique *three-directional action* of this new, patented "multi-wave" buff assembly. Its radical construction principle minimizes chances of buff overheating, and reduces or entirely eliminates drag marks on non-ferrous metals.

Actual buffing tests on a variety of pieces over a wide range of speeds have indicated that the Multi-Wave principle adds extra life to buffs.

H-VW-M Multi-Wave Buff Assemblies are available in diameters from 12" up and in various grades of cloth and types of sewing. Ask a H-VW-M representative to call and survey your buffing conditions and suggest how the Multi-Wave Buff Assembly could reduce buff costs for you.

2749

HANSON-VAN WINKLE-MUNNING COMPANY

MATAWAN, NEW JERSEY

Manufacturers of a complete line of electroplating and polishing equipment and supplies

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***Sales Offices:* Anderson • Chicago • Cleveland • Dayton • Detroit**
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NO. 1 IN A SERIES
"KNOW YOUR KENNAMETAL"
for
Design Engineers

"HARDNESS OF KENNAMETAL"

HIGH HARDNESS OF KENNAMETAL
is Important Aid in
DESIGNING FOR DURABILITY

Many revolutionary, worthwhile, and mechanically sound designs of machines and equipment have been discarded because they were deemed impractical or too short-lived with the materials then used, but with the availability of Kennametal such designs may be quite feasible and successful.

The high degree of hardness, strength, resistance to wear, and other distinctive characteristics of Kennametal show why it gives superior service under heavy duty use, where strain, shock, heat, and wear are destructive to other metals.

Extreme hardness is an outstanding property of all Kennametal compositions. As can be seen in the table below the softest grade of Kennametal—"K12"—is 74 Rockwell C, or 89 Rockwell A, and is therefore harder than the hardest tool steel which rarely exceeds 66 Rockwell C. These figures, however, do not adequately express the great difference in use, in durability, because differences of a few points at the upper end of the Rockwell scale are more important than the numerical value indicates.

	Material	Hardness Test			
		Rockwell		Vickers 30 kgs. Load	Knoop 2000 grs. Load
		60 kgs. A	150 kgs. C		
KENNAMETAL	KM	91.0	77.6	1149	1300
	K3H	92.0	79.6	1238	1460
	K4H	92.2	80.6	1324	1500
	K5H	93.1	82.2	....	....
	K2S	91.5	79.0	....	....
	K6	92.2	80.6	....	....
	K12	89.0	74.0	....	....
	KE5	89.0	74.0	....	....
	KE7	91.0	77.6	....	....
STEEL	HSS 18-4-1 Heat treated	max. 85.0	max. 66.0	960	....
	1.10% C. Heat treated	max. 83.0	max. 62.0	437	....
	Co., Cr., W. Alloys	83.5 to 85.5	63 to 67	....	....
	Brass 60–40 cold drawn	86.7 B Scale		....	....

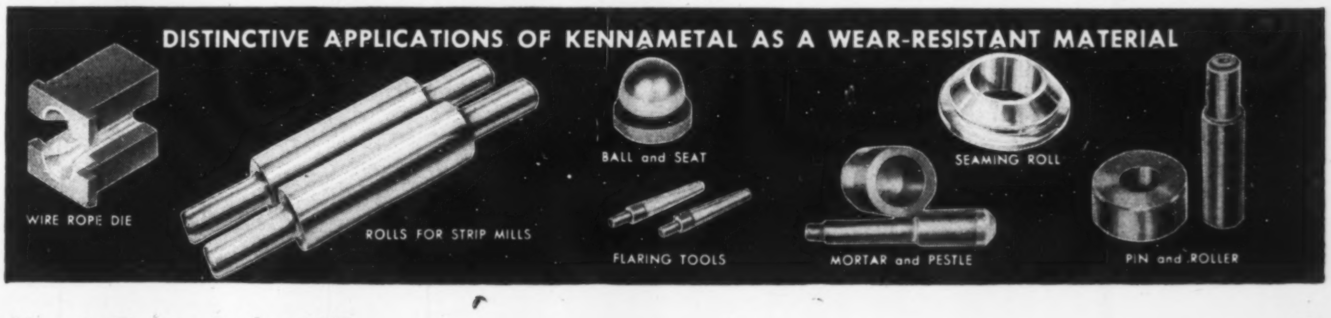
Moreover the hardness, by the Rockwell test, of cemented carbide compositions is no measure of the hardness of the particles of carbide ingredients making up the majority of the composition. Thousands of these are displaced in the matrix by the Rockwell penetrator so that the test measures more the amount of binder metal present and the state of sub-division of the particles than the hardness of the carbide constituents. These hard carbide particles are between sapphire and diamond in scratch hardness tests. Tungsten-titanium-carbide, $WTiC_2$, produces definite scratches on tungsten carbide, WC, in crystalline form, and is hence harder than tungsten carbide.

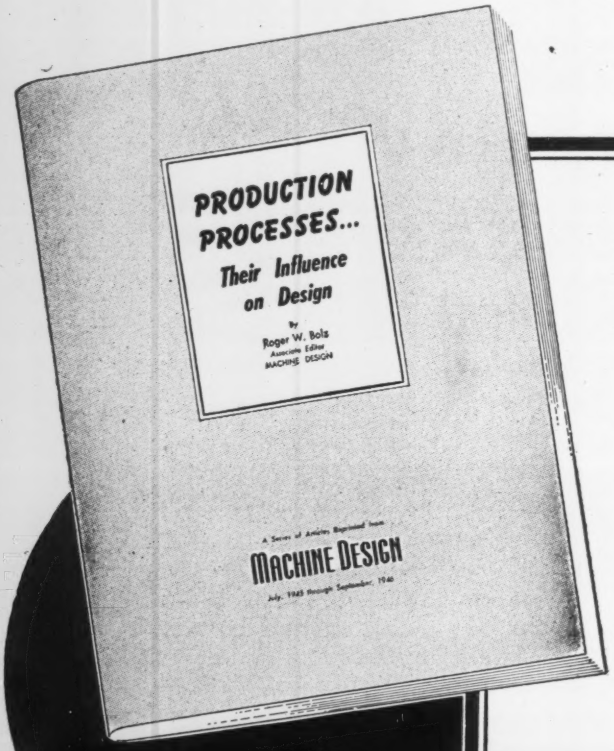
It is the combination of desirable transverse rupture strength that makes it technically and mechanically useful, high Rockwell A hardness, and resistance to wear due to composition and structure that distinguishes the successful and valuable cemented carbide compositions.

These and other mechanical and physical properties are fully discussed in our new technical bulletin—"Characteristics of Kennametal." A copy of it will be sent to you upon request.

KENNAMETAL *Inc.,*
TRADE MARK REG. U. S. PAT. OFF.
SUPERIOR CEMENTED CARBIDES
KENNAMETAL *Inc.*, LATROBE, PA.

DISTINCTIVE APPLICATIONS OF KENNAMETAL AS A WEAR-RESISTANT MATERIAL





PRODUCTION PROCESSES...
Their Influence on Design
By
Roger W. Bolz
Associate Editor
MACHINE DESIGN

A Series of Articles Reprinted from
MACHINE DESIGN
July, 1945 through September, 1946

PRODUCTION PROCESSES...

THEIR INFLUENCE ON DESIGN

By Roger W. Bolz
Associate Editor, MACHINE DESIGN

PRICE $1.00* POSTPAID
100 PAGES
PROFUSELY ILLUSTRATED

IMPORTANCE of mass production processing methods relative to their tremendous influence upon practical, economical and satisfactory design is gaining wide recognition. Design changes to simplify and reduce the cost of manufacture after release of parts to the shop are usually costly and often cause undue delays. To assist the designer in evaluating the various processing methods available and help in achieving the advantages of maximum economy, accuracy and speed in the manufacture of tomorrow's machines, a series of articles are appearing currently in MACHINE DESIGN. The first fifteen parts, listed at the left, are now available as a bound volume.

15 CHAPTERS OF PRODUCTION PROCESSES

•

BROACHING
SPINNING
SCREW MACHINING
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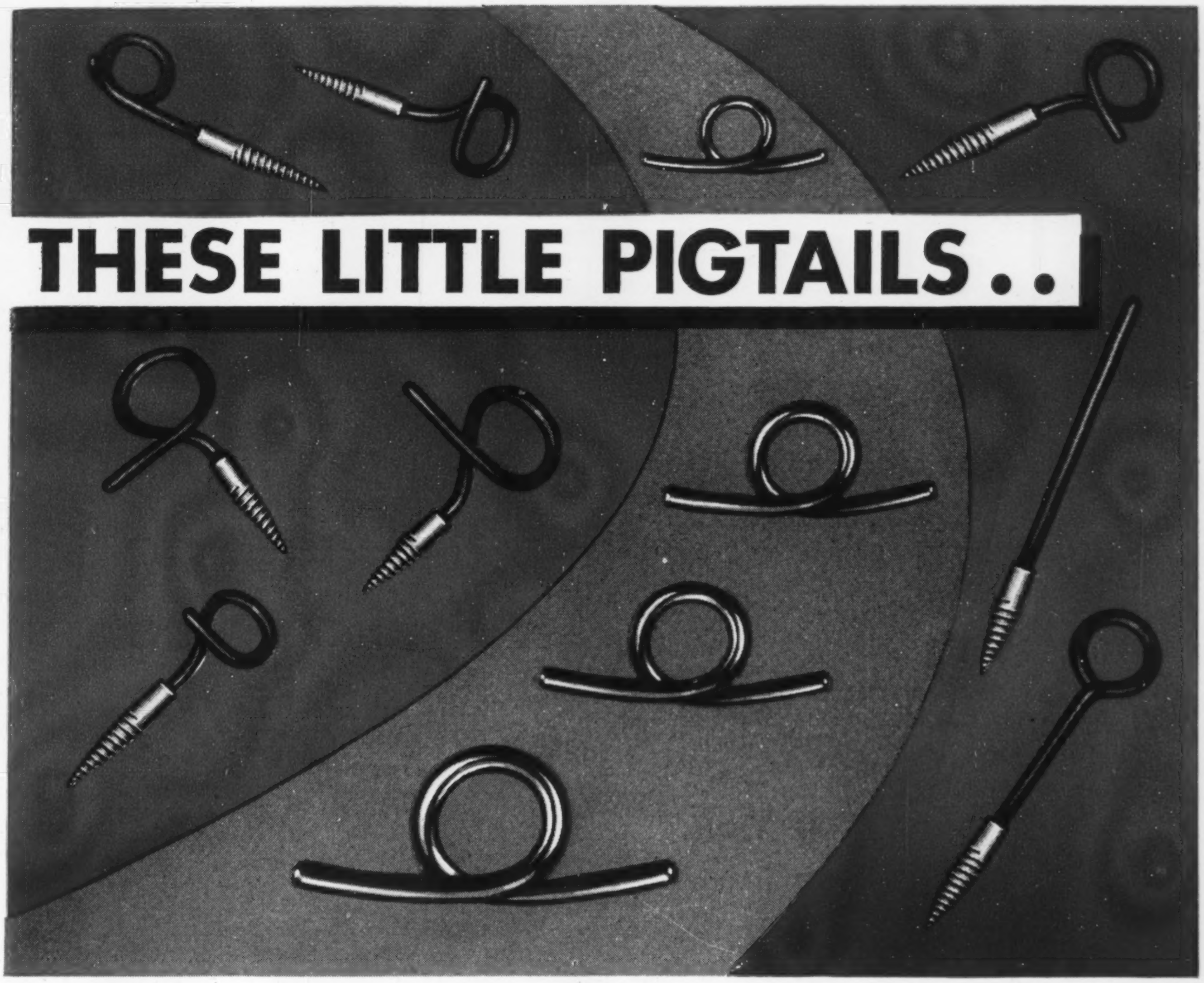


THESE LITTLE PIGTAILS..

...bring Home the BACON!

COSTS COME TUMBLING DOWN when these Carboloy Cemented Carbide "pigtail" guides are installed on textile machines, and the reasons why are important to every industry. Hard, twisted raw silk and other soft, but *abrasive* textile yarns wear rapidly through hard steel or porcelain guides, necessitating frequent replacement. This means textile machine downtime and production loss, as well as high replacement cost.

With Carboloy Pigtail Guides, machines operate more continuously . . . textile production goes up . . . and *replacement costs come tumbling down!*

Carboloy Hard Metal is bringing unusual benefits in the production and use of thousands of products from fish rods to metalworking machine wear-plates. Its resistance to excessive wear makes equipment last longer and operate better. Interested in cost savings for *your* product? Then check wear resistant uses of Carboloy Cemented Carbides. Carboloy Company, Inc., 11113 E. 8 Mile Ave., Detroit 32, Michigan.

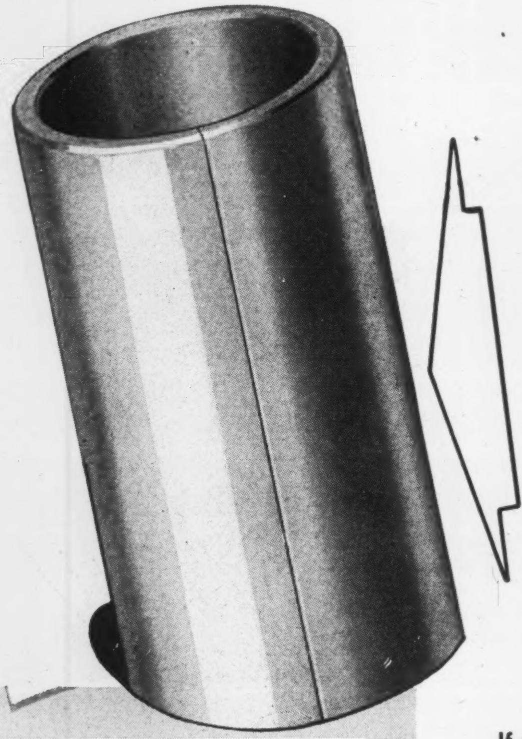
CARBOLOY®

Hard Metal

TO REDUCE WEAR ON
MACHINES AND PRODUCT PARTS

another typical example of how

THE FORMETAL IQ* means lower costs to you



the bearing that created a $13,800 $URPLU$

to get your product really rolling...use

FORMETAL

Superformed

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If you use bushings or bearings, you ought to know about FORMETAL's *Improved Quality . . . because it means dollar savings to you. A manufacturer of small motors, for example, recently ordered FORMETAL Superformed Bearings to replace the bearings he was using. Result: Performance is far better and the saving amounts to over $13,800—a sizable amount for so small an item!

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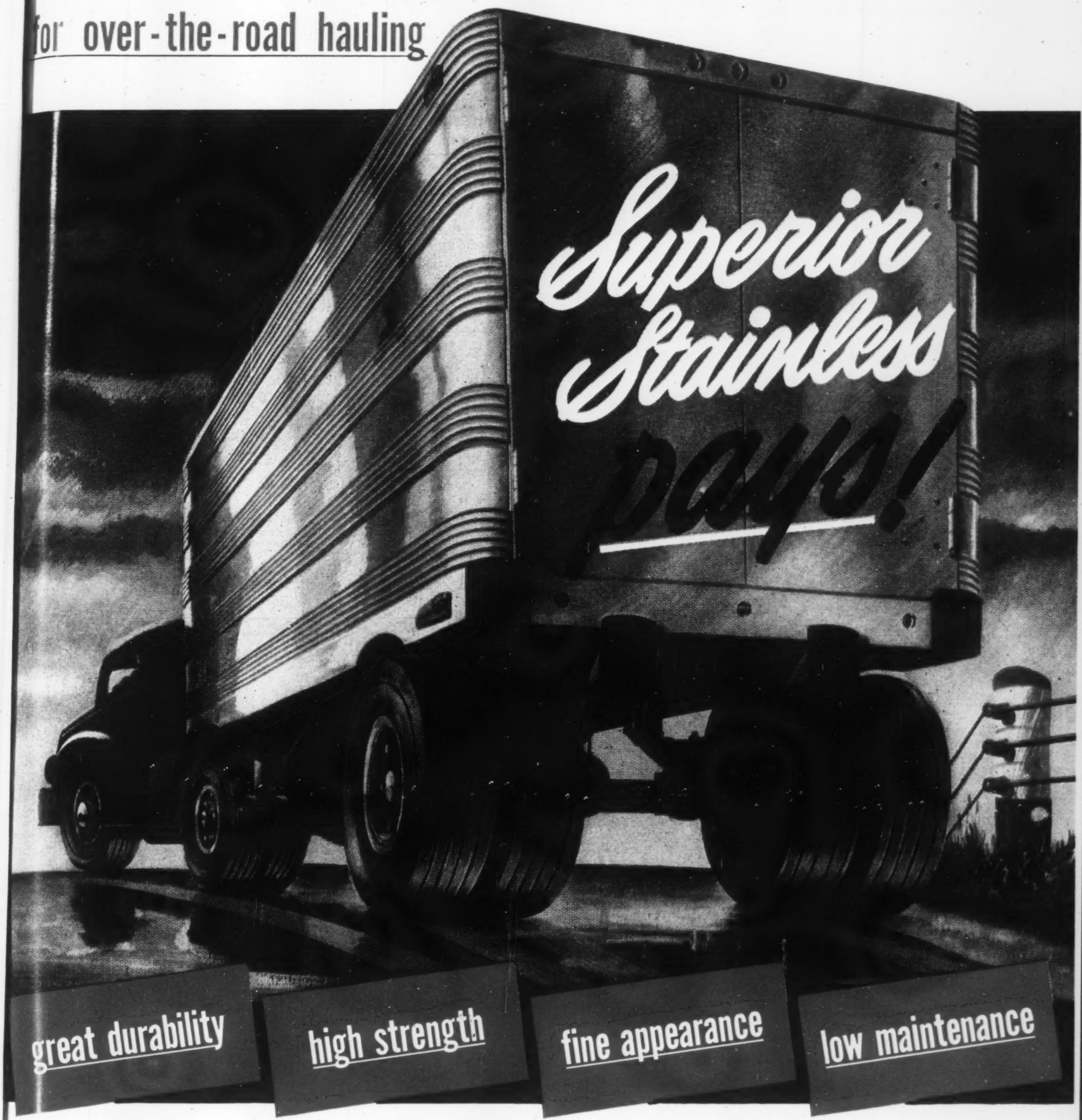
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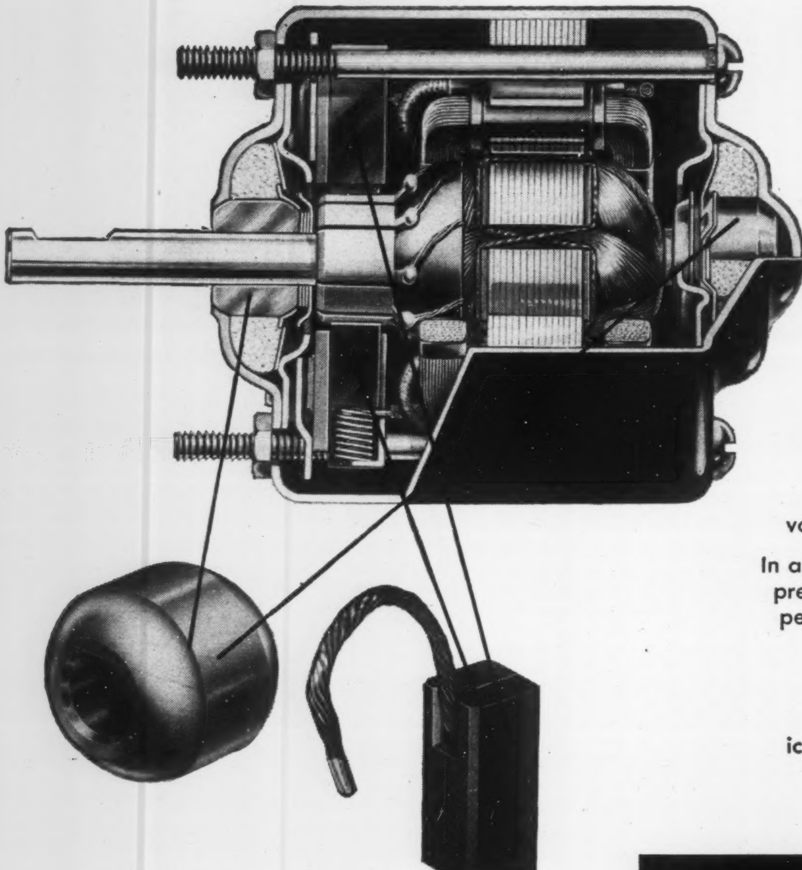

Gramix powder metal bearings and U. S. G. brushes are two important reasons for the outstanding dependability of Redmond Micromotors. U.S.G. copper-graphite brushes have high current carrying capacities and provide positive, noiseless commutator contact. The Gramix bearings reduce shaft play and noise, because they are self-aligning and are selectively fitted to the shaft to retain clearance within .0005". They provide automatic lubrication, with microscopic pores that filter lubricant from the reservoir and distribute it evenly and freely.

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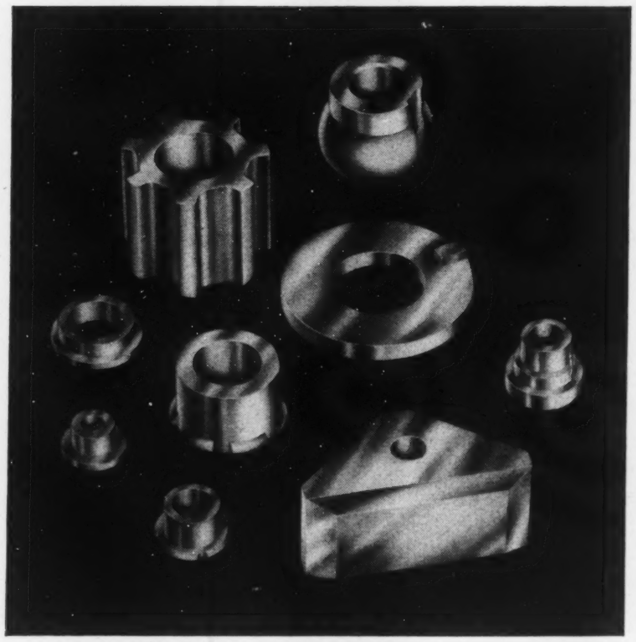

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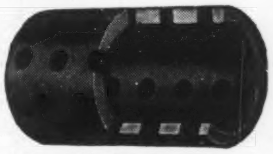
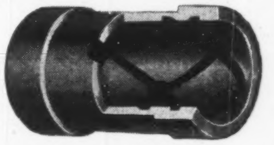
for bearings that assure quiet trouble-free service 3 to 4 times longer specify

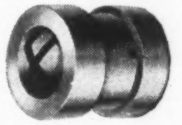
RANDALL



Drilled holes provide graphite lubrication.



Above and below—bearings undercut for oil reservoirs in housing



You write bearing failures out when you write *Randalls* into your design specifications. These bearings are precision machined from sand cast phosphor bronze, with grooves or plugs permanently filled with porous, lubricating graphite.

When used in an oil reservoir housing, oil feeds through the graphite, so there's always an oil-graphite film between shaft and bearing. You're sure of quiet, dependable service, 3 to 4 times longer, when you specify Randall graphite-bronze bearings or . . .

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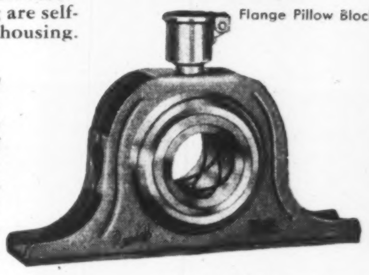

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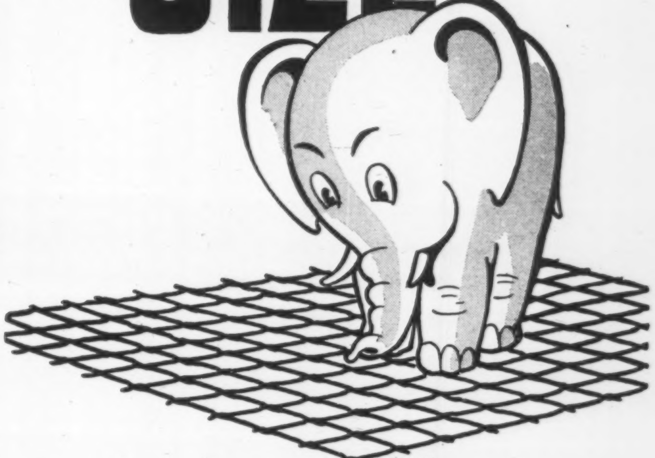

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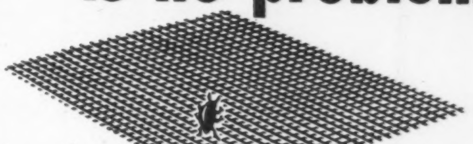

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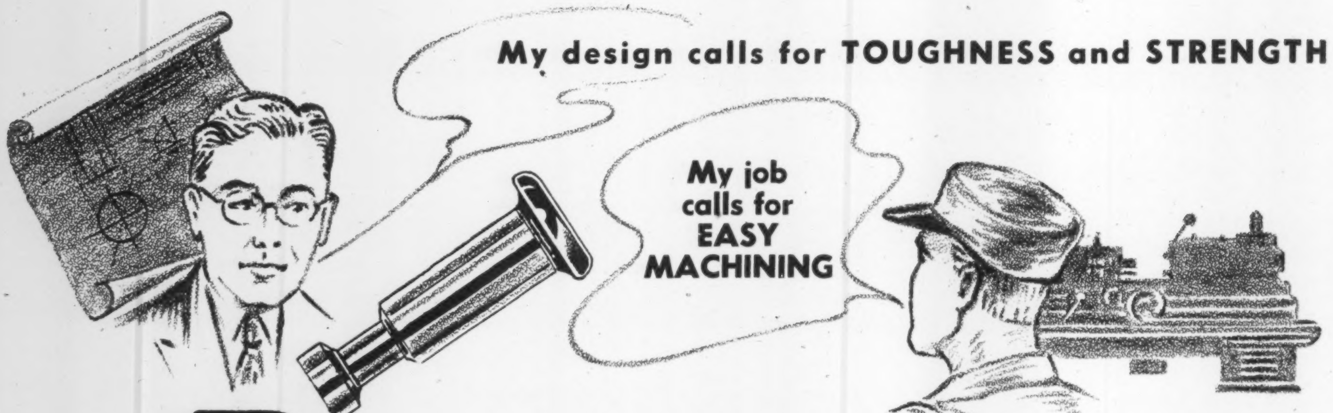
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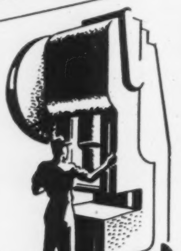

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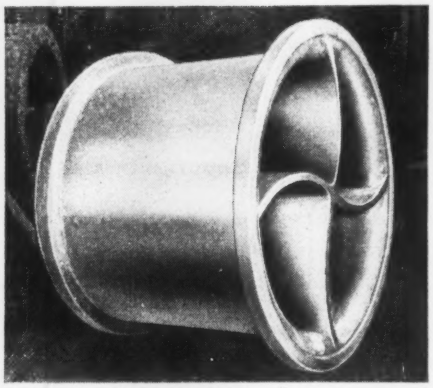

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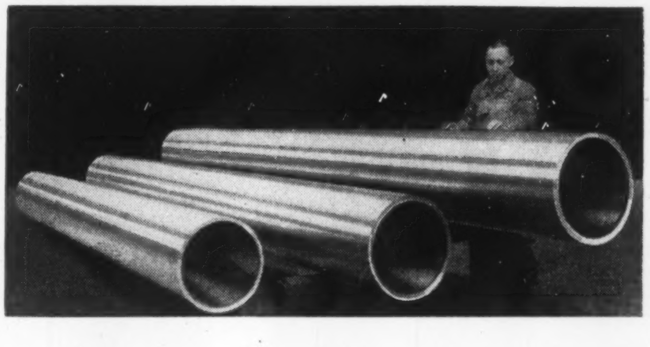

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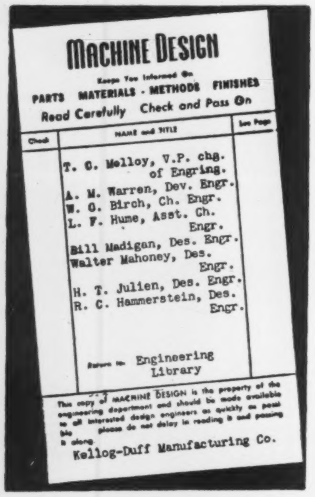

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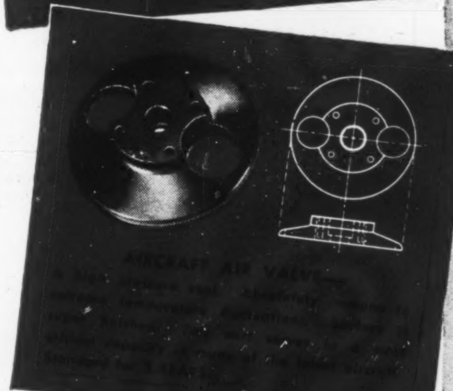

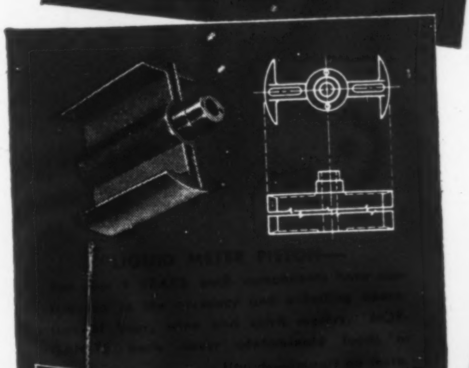

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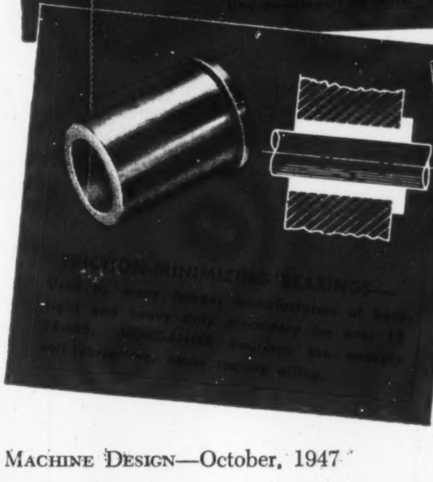

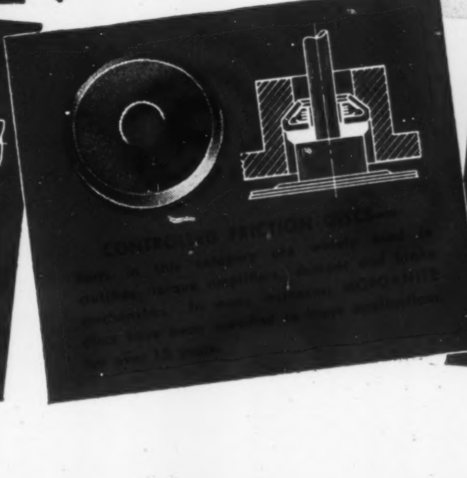

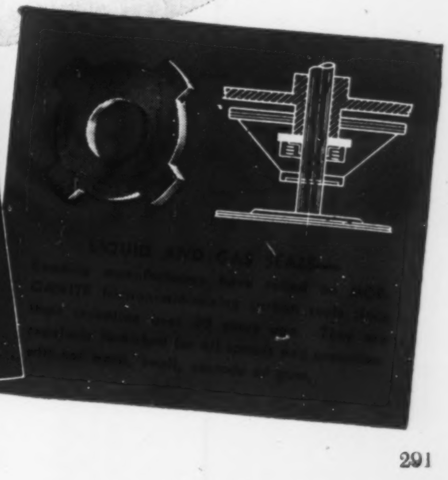

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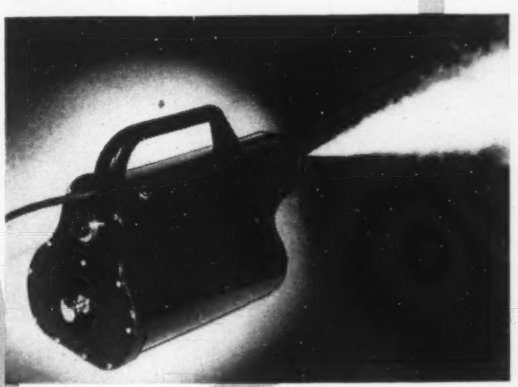
The Commando Aerosol Gun, made by Mayfair Industries, Inc., Chicago, produces a vapor of very fine insecticide particles by means of heat vaporization. The new principle of dispersion makes necessary radical changes in the present conception of mode of action and methods of application of insecticides. The Commando Aerosol Gun is widely used by commercial and industrial companies to control insect pests.



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SOLUTION — Back plate was joined to body of gun by Reliable bonding using a proper synthetic material as a bonding element.

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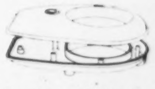

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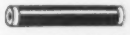

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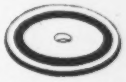

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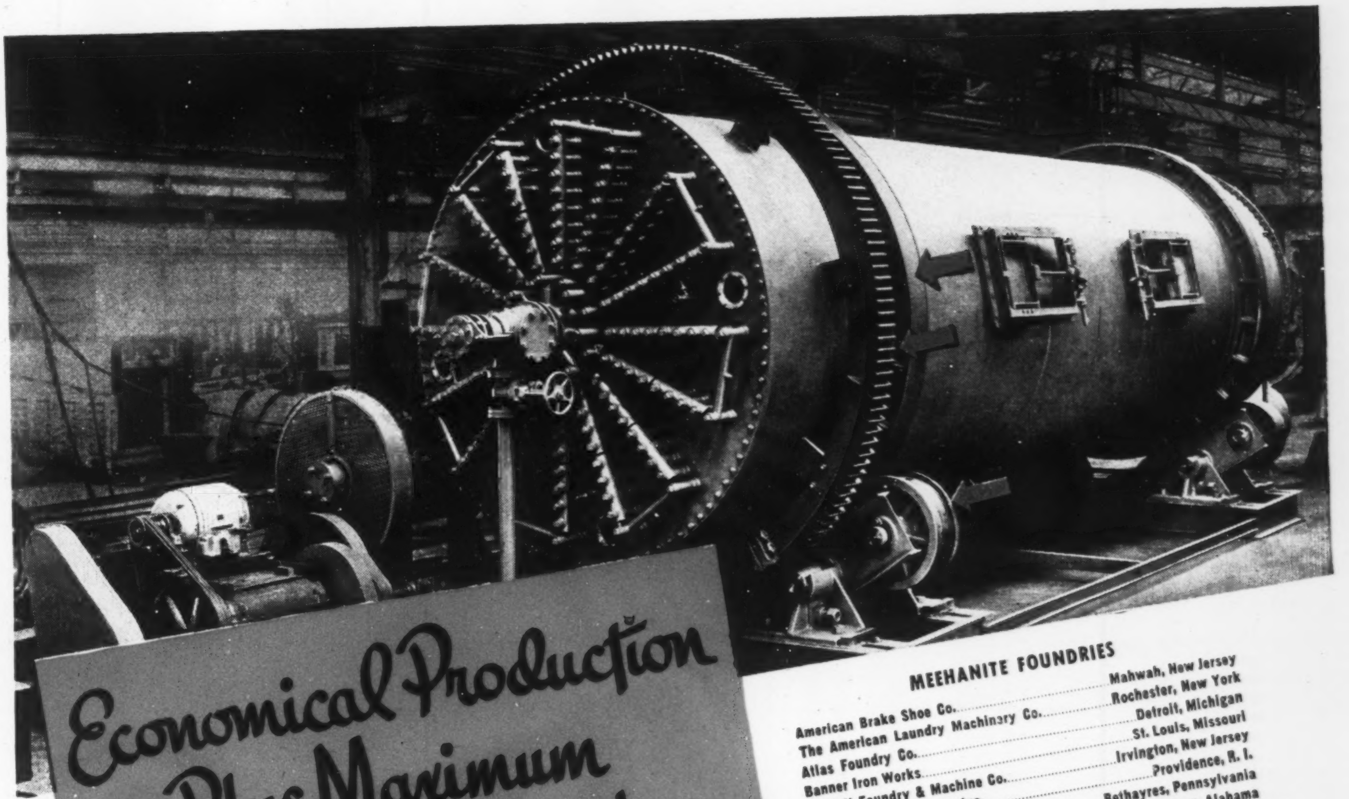

Economical Production Plus Maximum Service Life with-

MEEHANITE® CASTINGS

● Builders of the equipment like the LaFeuille Sugar Crystallizer illustrated demand that their products provide maximum performance in service and at the same time are on the constant look-out for improvement in production efficiency. For these reasons the Dorr Company, New York, N. Y., prominent designers and manufacturers of processing machinery, such as thickeners, classifiers, clarifiers, and LaFeuille crystallizers, have insisted upon the most extensive use of Meehanite castings possible.

The sugar crystallizer presents a combination of improved service life as a result of the advantages of the better engineering characteristics in Meehanite castings with an improvement in the efficiency of the fabrication method.

The tires, rollers and drive gear are Meehanite castings. The tires, made in halves, are machined to provide a tight fit to the crystallizer shell and are simply bolted together. The Meehanite drive gear is bolted to supporting lugs.

Formerly large steel tires were welded around the entire shell, whereas the bolted Meehanite tires may now be easily replaced and running as they do against the Meehanite rollers provide a combination resulting in maximum wear resistance.

For further information along these lines write for our booklet "The Role of Castings in Engineering Production."

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... to your drive applications

When you select a unit to reduce prime mover speed, be sure to get the plus features offered in Westinghouse Speed Reducers.

High operating efficiency and long service life are assured by Westinghouse design, precision manufacturing methods and selection of materials used in construction.

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Get in touch with your nearest Westinghouse office for assistance on the application of Westinghouse Speed Reducers to your own drives. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-07260

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Type SH speed reducer—a single-reduction unit furnished in 13 standard ratios in each of 12 sizes. Type DH speed reducer (cutaway view, below) is a double-reduction unit, offered in 15 standard ratios in each of 12 sizes. Power transmission efficiency of Type SH averages 98%. Type DH averages 96%.

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ANTIFRICTION BEARINGS—Tapered roller bearings are used throughout, assuring permanent shaft alignment, minimum friction loss and long, trouble-free service.

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Westinghouse Industrial Geared Drives are fully described and illustrated in Booklet B-3730. Write for your copy.

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Inside diameter just 1/16"... Outside diameter only 1/8"... Cross section a mere 1/32"... Working to those narrow limits it stands to reason that nothing could serve except utmost precision. So the manufacturer who had to have perfect "O" rings in midget size came to Linear.

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Maybe yours is a difficult special application, but put it up to Linear engineers. Their experience and facilities—their laboratory and operating tests—insure a finished product that's fit! Send complete data and plans to *LINEAR, INC., STATE ROAD AND LEVICK STREET, PHILADELPHIA 35, PENNSYLVANIA.*

* * *

NOTE: *Linear "O" rings are covered by Christensen United States Patent No. 2,180,795; all "O" rings sold by Linear are manufactured under royalty agreement with patentee.*

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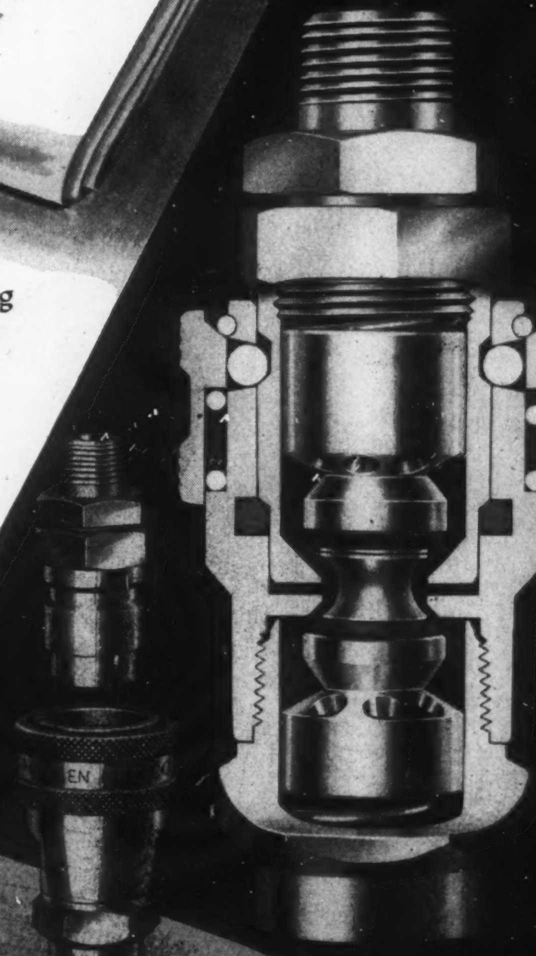
TWO-WAY SHUT-OFF COUPLING

• SEALS BOTH ENDS OF LINE—

AUTOMATICALLY... INSTANTANEOUSLY •

The new Hansen two-way shut-off coupling provides for easy—quick—safe connecting and disconnecting of hydraulic and pneumatic lines. This unique "spool type" valve coupling permits the instant sealing of each end of the lines immediately upon disconnection of plug from socket. To connect, you pull back sleeve and merely push plug into socket—coupling is connected and locked—valves in socket and plug are open, automatically permitting oil or gas to flow freely in either direction. To disconnect, push back sleeve — this disconnects coupling. Socket and plug are each positively sealed, automatically preventing loss or spillage of fluid. Check the many advantages in time, labor and cost savings provided in this new Hansen two-way shut-off coupling.

Full details in new Hansen Bulletin.
Write for your copy.



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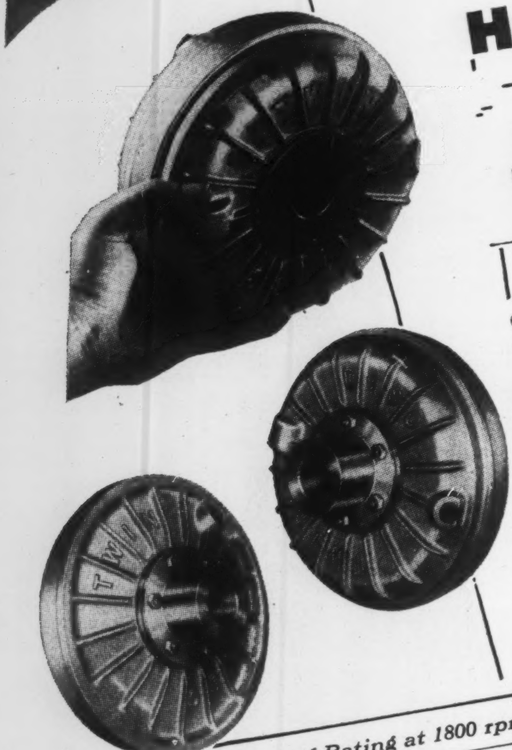
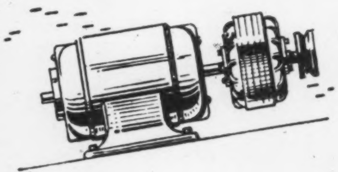
WIDER HP RANGE

for Small Hydraulic Couplings



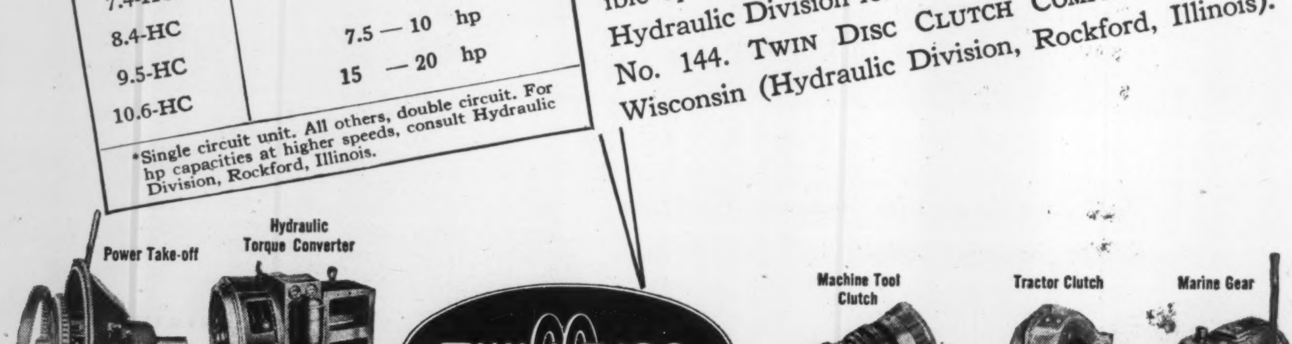


The horsepower range of the Twin Disc Small Hydraulic Couplings has been expanded to include capacities up to 80 hp at maximum speeds of from 2800 rpm on the largest unit to 4000 rpm on the smallest unit. Originally designed for application to internal combustion engines and electric motors in the 1 to 25 hp range at 1800 rpm, quick acceptance of the Small Hydraulic Coupling encouraged the Twin Disc Clutch Company to make it available for more widespread usage.

The Twin Disc Small Hydraulic Coupling helps overcome the inadequate torque and excessive current consumption of engines and electric motors. It also minimizes the need for complicated and expensive starting devices. Permitting delivery of full torque and preventing stalling, the use of these Small Hydraulic Couplings provides a smoother, more flexible operation. For complete information, write the Hydraulic Division for the newly published Bulletin No. 144. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Model	*Nominal Rating at 1800 rpm*
7.4-SHC*	¾ — 1.5 hp
7.4-HC	2 — 3 hp
8.4-HC	5 hp
9.5-HC	7.5 — 10 hp
10.6-HC	15 — 20 hp

*Single circuit unit. All others, double circuit. For hp capacities at higher speeds, consult Hydraulic Division, Rockford, Illinois.



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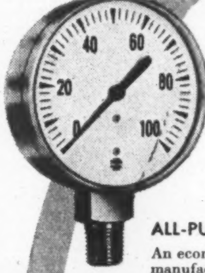
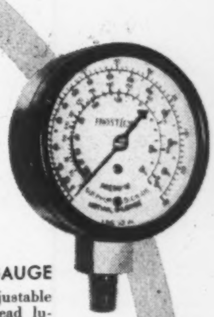
A superior quality gauge of top-most accuracy and durability, designed especially for chemical and oil refinery applications. Furnished in 4½", 6", 8½", 12" and 16" dial sizes . . . from vacuum up to 100,000 pounds per square inch pressures.



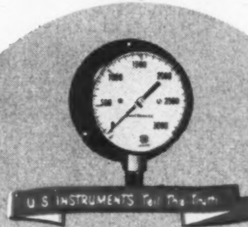
ALL-PURPOSE PRESSURE GAUGE

An economically priced pressure gauge manufactured to commercial accuracy. It has a phosphor bronze bourdon tube and a corrosion-resistant movement. It's smart in appearance and dependable in performance.



REFRIGERATION GAUGE

Important features include: adjustable hub pointer, broad easy-to-read luminous dial, removable screw check. Low side gauge has 1" and 1 lb. graduation and is protected to 200 lbs. overpressure. Also available with external calibrator and retarded movement.

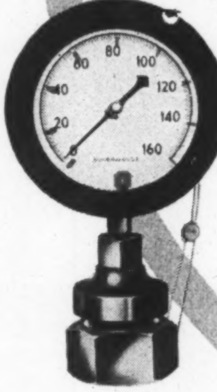


6 out of 10 Manufacturers Buy US Gauges

USG

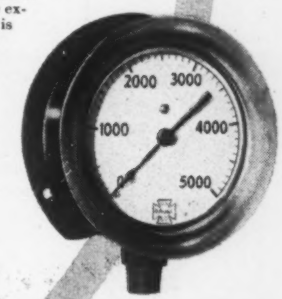
CHEMICAL GAUGE
Clean-Out Type

Designed for service in chemical and processing plants for use on heavy viscous fluids that tend to clog. Supplied with precious metal diaphragms and assemblies for highly corrosive chemical application. Diaphragm is easily removed for cleaning.



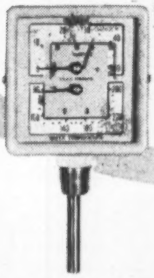
HYDRAULIC GAUGE

A gauge built to give continuing and accurate measurement of hydraulic pressures. The extra heavy-duty movement is designed to withstand the severe shocks and rugged service required of gauges when installed on hydraulic presses and Diesel engines.



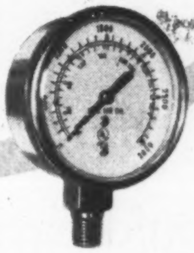
BOILER GAUGE

For use on hot water heating systems. Indicates on one dial: water temperature, head of water above gauge and pressure in system. Rugged construction with easy-to-read dial. Available in round or square case.



WELDING GAUGE

This well designed gauge incorporates the safety blowout features in the low as well as the high pressures. It is especially designed to withstand rugged handling. It is a tough gauge for a tough job.



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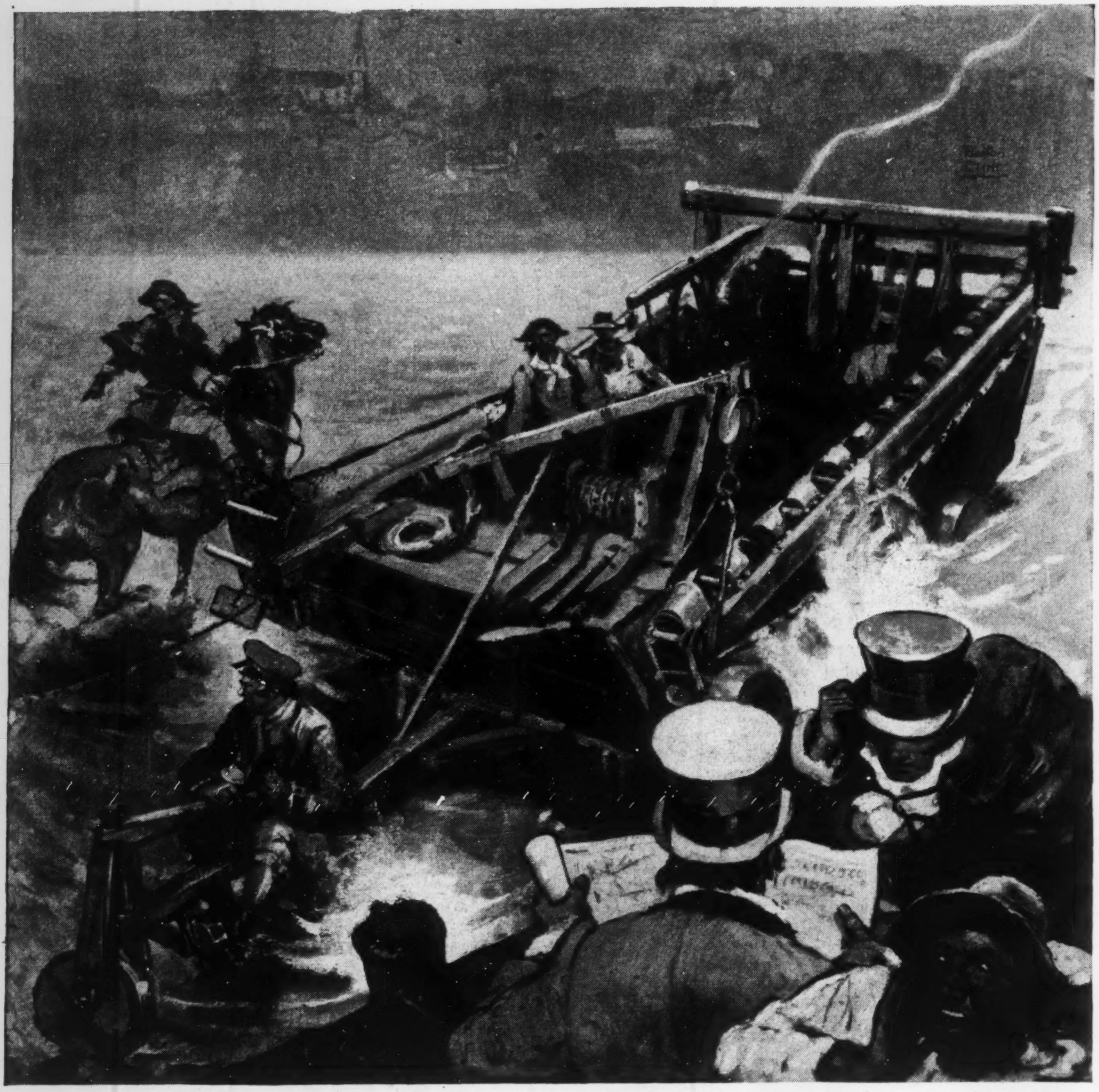


*The "Orukter Amphibolos," a steam-powered, amphibious dredge, built by Oliver Evans in Philadelphia, in 1803, shown emerging from the Schuylkill River.

His genius would have been futile without hard work

The "Orukter Amphibolos"* was more than a curiosity in 1803. An amphibious dredge, it began a new era — the mechanization of contracting industries. Its greatest claim to renown came from its inventor, Oliver Evans. First to design a high pressure steam engine, he built engines for pumping and hoisting, invented the elevator, conveyor, descender and the hopper for flour mills. But his foremost genius was for conscientious work ... with that he made new industries possible.

American creative genius would have been futile without management ability and honest toil to develop our industries. This nation has become a beacon of hope for the world because sound management and conscientious work have together turned scarcity into abundance. We'll have that abundance in greater measure only if everyone realizes that even machines won't produce without an honest day's work to keep them going.

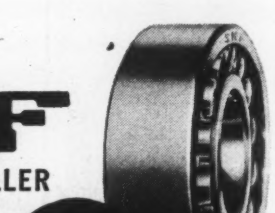
• • •

If Evans were alive, he would advocate the use of anti-friction bearings in contracting equipment. Made in every size and type that industry needs, SKF ball and roller bearings are found everywhere in modern, high speed contractor's machines. They helped to make Boulder Dam and other great construction projects possible; and everywhere they prove to be:

THE RIGHT BEARING FOR THE RIGHT PLACE

SKF

BALL AND ROLLER BEARINGS



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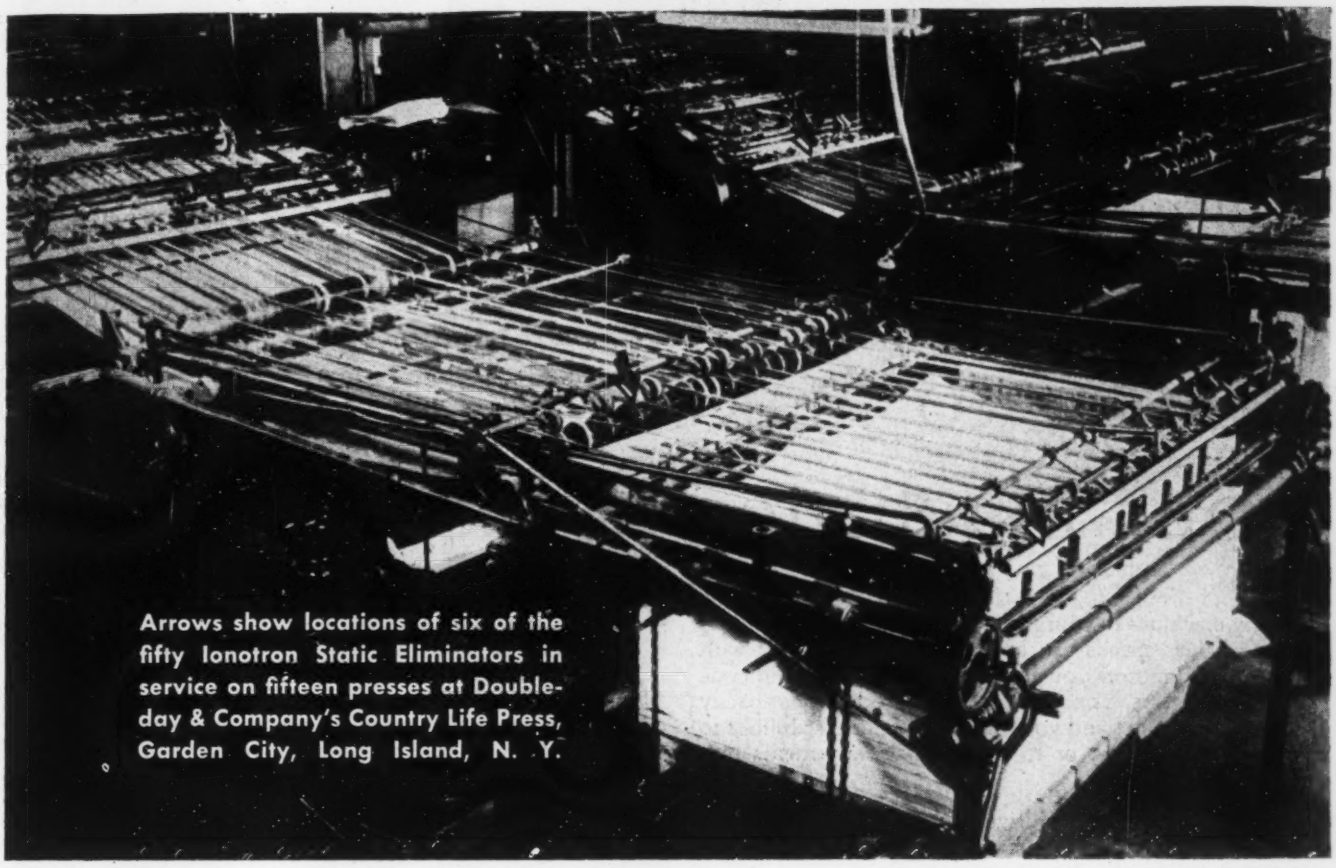

Arrows show locations of six of the fifty Ionotron Static Eliminators in service on fifteen presses at Doubleday & Company's Country Life Press, Garden City, Long Island, N. Y.

New method of eliminating static problems is effective on many kinds of machines

Recently the United States Radium Corporation developed a means of employing continuous alpha radiation to overcome static problems on machines for printing, coating, finishing, packaging, and other operations where friction generates troublesome static electricity. Alpha rays ionize air, making it conductive to electricity. U. S. Radium engineers have produced a unit — called the Ionotron Static Eliminator* — which uses this principle to eliminate static problems by continuously conducting charges to ground as they accumulate.

There are no moving parts — no contact with moving materials — no accessory apparatus. The Ionotron requires no power connection and no maintenance other than occasional wiping to remove dust or dirt. There is no operating cost, and the action of the Ionotron is permanent.

Valuable in many ways, in many applications! The installation of Ionotron Static Eliminators minimizes static-caused production interruptions . . . irregularities in finished products . . . fire and explosion hazards.

The Ionotron reduces static charges in paper, foil, fabric, cellophane, rubber, synthetics, and other materials.

Units can be obtained in proper dimensions for almost any type of equipment. Application is so simple that it rarely necessitates any modification of basic design.

By incorporating Ionotrons into your designs, as either standard or optional equipment, you can give your machines an attractive advantage over competitive makes.

•

Send coupon for details! To get further information about the use of Ionotron Static Eliminators on the types of equipment you are designing (or using), fill in and mail the coupon below.

**Trade-mark reg. U. S. Pat. Off.*

USR

IONOTRON
Static
ELIMINATOR

DEPT. K3, U. S. RADIUM CORP.
535 Pearl Street
New York 7, N. Y.

☐ *Please send me your bulletin describing the Ionotron Static Eliminator.*

☐ *Attached are details of the static problem(s) I am interested in eliminating.*

Name____________________

Title____________________

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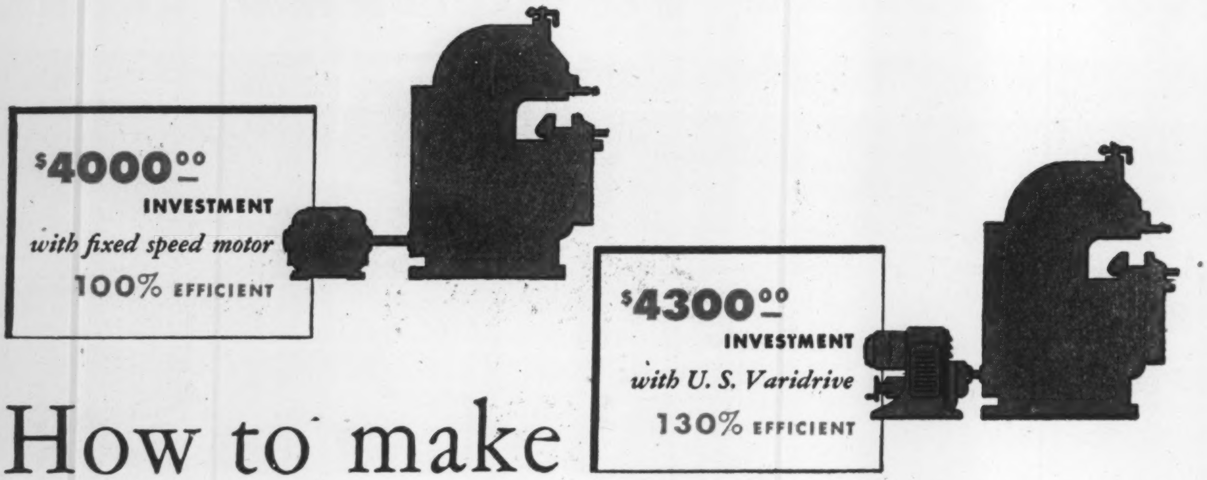
City__________ State__________

A tip to the very wise... Buy Varidrives



How to make your machine *pay a Bonus!*

Many machines in your plant will turn out more production if their speeds can be quickly changed. But with fixed speed motors you are limited to the speeds of cone pulleys or gears. You restrict the full production capacity of your machines and you limit the operator's abilities to speed up his work or to synchronize movements best suited to his tempo.

By installing U. S. Varidrive Motors you increase your machine's performance in many ways. You give your operators the right speed so they can work at peak capacity.

Assuming a shop tool costs you $4000, with a motor of fixed speed, let's figure its operating factor at 100%. By powering it with a U. S. Varidrive instead of with a fixed speed motor, for a few dollars more you make that tool turn out far more production—10%, 20%, 30% or even more. You can speed up for peak loads, drop down to a slower speed for work requiring diminished movement—just by the turn of a handwheel. You enable your operators to get more satisfaction in their work—and you profit by having the most modern power drive ever conceived.

Think of the places in your plant where variable speed will help drive down operating costs. Then apply Varidrives at a fraction of the cost of the machines.

Ask for interesting illustrated U. S. Varidrive Motor literature. It describes the complete range of sizes and types.

Varidrive
DESIGN FEATURES
Self-contained, compact unit.
Speeds from 1 rpm to 10,000 rpm.
Smooth running, shockless transmission.
Instant change from speed to speed.
Quiet, anti-friction operation.

U.S. *Varidrive* MOTORS
THOUSANDS OF SPEEDS AT THE TURN OF A WHEEL

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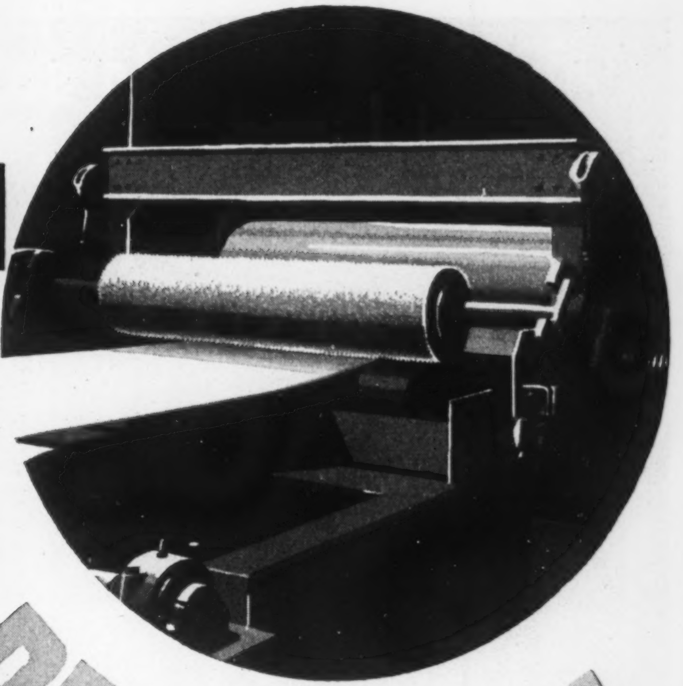

How to give a cold rolled strip the BRUSH-OFF

● A characteristic problem of cold roll strip production is the removal of oil and other foreign matter. Pittsburgh has solved this by a 3-color, dense filled, medium stiff brush. This special brush of even trim, spiral wound, removes all rolling oil and other foreign matter after the strip has passed through a heated alkaline bath and been sprayed by clear water.

Such a brush has to take plenty of punishment for it is constantly subjected to both the softening effect of water and rapid friction of the strip. Brushes by Pittsburgh are skillfully and durably built to withstand this heavy going.

Why the Pittsburgh Plate Glass Company Makes Brushes

As a leading manufacturer of paints, Pittsburgh found that a reliable source of quality brushes was necessary for the proper application of its products. For over 40 years, Pittsburgh has made its own paint brushes. It was a natural step to extend its engineering and manufacturing facilities by developing production, maintenance and power-driven brushes engineered to the specific needs of industry.

It pays to use power-driven brushes by Pittsburgh

● You can depend on Brushes by Pittsburgh for top performance, enduring economy, and a minimum of lost time in changeovers. In the complete Pittsburgh line are brushes of all types, including "Perfect Balance" sections, wheels and section assemblies, Uni-Fill scratch brushes, as well as paint and other maintenance brushes. ● Consult the Pittsburgh engineering representative. He will gladly work with you in developing any type of power-driven brushes to meet your particular finishing requirements.

PITTSBURGH
PLATE GLASS COMPANY *Brush Division*
3221 FREDERICK AVENUE · BALTIMORE—29 · MARYLAND

Just why do so many firms always come to PHILADELPHIA for their gears?

The answer is really simple: (1) Because we have been making *nothing else but gears* (and geared products) for over 55 years. (2) We have one of the *largest industrial gear shops* in America. (3) Our machines are of the *most modern types.* (4) Our shop arrangement, facilities and equipment are *right up-to-date.* (5) Our Executives, Designers and Gear Makers are all *long experienced people.* (6)Our *location is excellent* (on the Pennsylvania Railroad main line between Washington and New York). (7) Our laboratory and testing facilities are more than adequate. (8) Our deliveries are as *prompt as possible.* (9) Our reputation *as gear specialists speaks for itself.* —So, whether it's one or a quantity of any type of the following gears, it will pay you to *order* from "Phillie Gear": Spur, Worm, Herringbone, Planetary, Internal Spiral Bevel, Helical, Spiral, Miter, Intermittent, Hypoid, Zerol — and such non-metallic gears as Rawhide, Fabroil, Textolite, etc.

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Send for the "Gear Book" which contains 56 pages of highly useful information; in fact, it's almost a "treatise on gears".

Please use your Business letterhead when writing for this catalog.

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Proper operating fit is the end result...correct running clearances maintained between the housing and shaft.

Taking the "measure" of a bearing to Federal's rigid standards involves over 100 individual production, inspection and cleaning operations—with *every fourth operator an inspector*. Out of this system of check and re-check, fifty years in the developing, Federal Bearings are equipped to deliver friction-free performance on any assignment.

Your application may benefit from a Federal Ball Bearing installation. Our representative in your vicinity will gladly talk it over with you. Write for catalog "K." It describes the complete line of Federal Ball Bearings.

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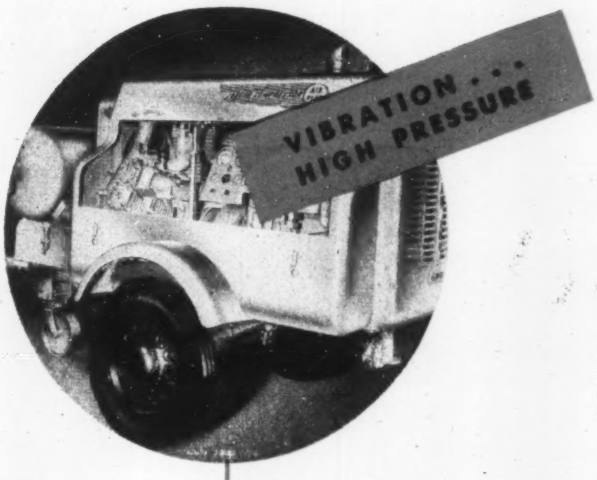
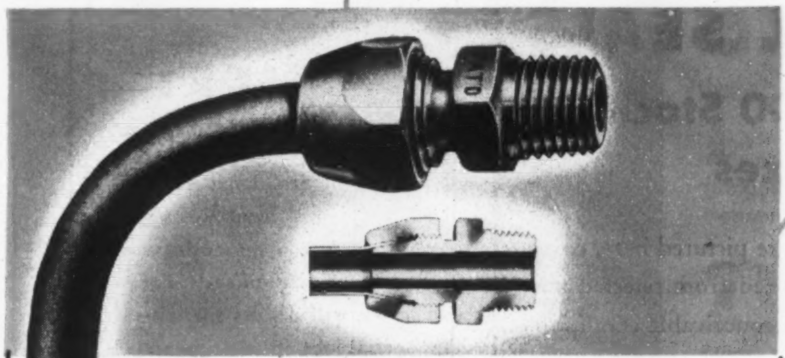
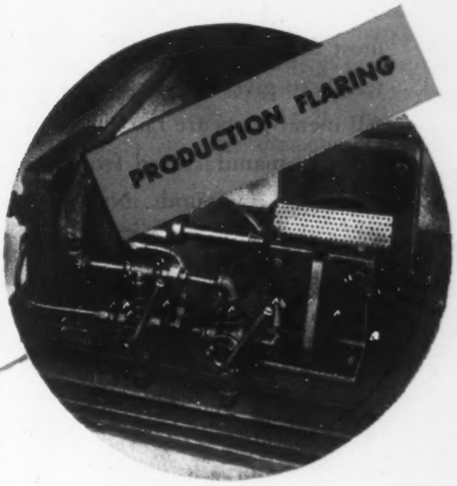
ONE OF AMERICA'S LEADING BALL BEARING MANUFACTURERS



ANY TUBING
COPPER
SEAMLESS STEEL
ALUMINUM
WELDED STEEL





LEAKPROOF JOINTS FOR LIGHT WALL TUBING

- ★ Long, smooth 10° flare provides greater sealing surface. No shearing action; tubing is actually strengthened.
- ★ Only single flare needed for any tubing.
- ★ Up to 2000 flares a day on inexpensive flaring machine.

Superseal FLARED TUBE FITTINGS

Approved by Underwriters' Laboratories for all hazardous gases and liquids.

HAS YOUR DESIGN THINKING shied away from light wall tubing applications when *vibration and high pressure* were present? It needn't if you specify Superseal fittings. The Jaeger Mfg. Co. tested these flared tube fittings exhaustively. One of the tests was on a gasoline engine driven compressor, which was run at full throttle for six hours at 600 p.s.i. They were convinced that Superseal fittings make a leakproof joint unaffected by vibration, perform entirely satisfactorily with welded steel tubing using only a single flare. As a result, Jaeger now standardizes on Superseal fittings for 4 compressor sizes.

Investigate Superseal fittings. Write for new Catalog 4-R, "Grinnell Superseal Flared Tube Fittings".

GRINNELL COMPANY, INC.
Executive Offices: Providence 1, R. I.

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Charlotte 1, N. C.
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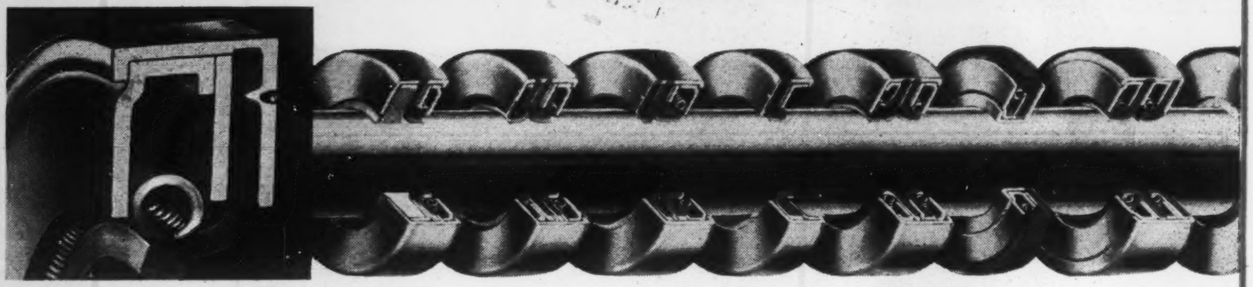
GRINNELL
FOUNDED 1850
WHENEVER PIPING IS INVOLVED

NATIONAL OIL SEAL LOGBOOK



NATIONAL OIL SEALS

Come in Over 1000 Stock Types and Sizes

Stock National Oil Seals, some of which are pictured here, cover most all applications. They are manufactured from selected materials to give efficient service under every conceivable condition. All metal parts are fabricated to precise tolerances. Sealing members are manufactured from Nationalized leather and from new synthetic compounds. National sealing members will withstand speeds reaching 3600 FPM and temperatures above 275°F.

Where water, acids or chemicals are a problem, National Oil Seal Engineers will design and fabricate special seals.

Full information on National Oil Seals is contained in National Seal Catalogs No. 101 and supplements. For more detailed information call in the nearest National Oil Seal Engineer. His long experience in helping solve sealing problems is at your disposal.

NATIONAL MOTOR BEARING CO., INC.

GENERAL OFFICES: Redwood City, California
PLANTS: Redwood City and Los Angeles, California; Van Wert, Ohio

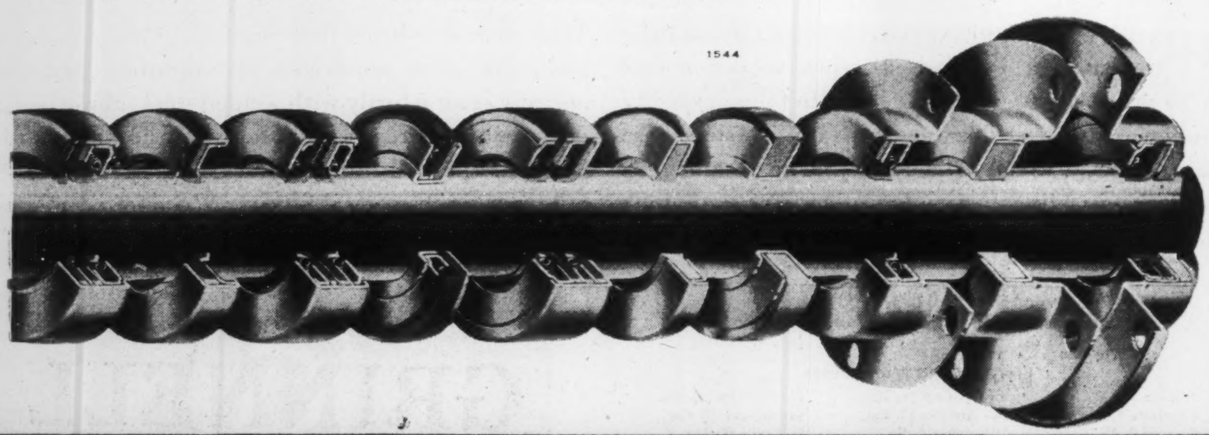
NOTICE:

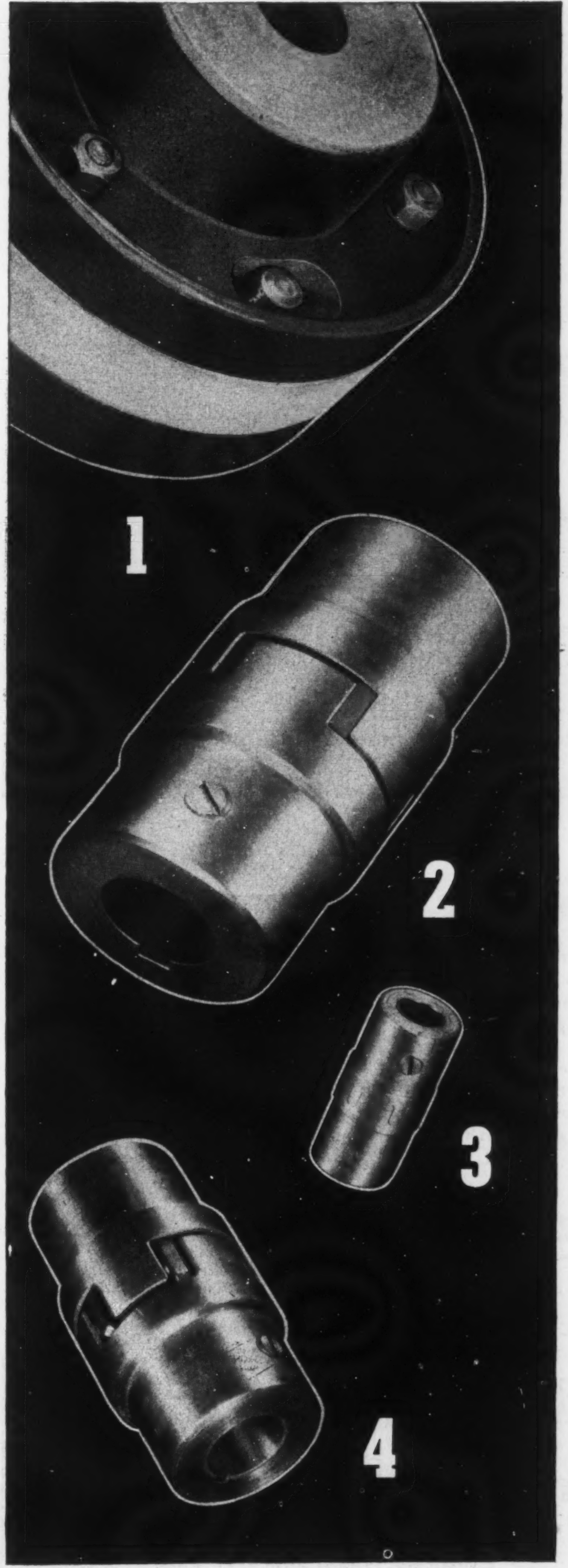
During the following months, the National Oil Seal Engineer's Logbook will appear regularly on these pages. It will contain much factual information about oil seals. For example—it will discuss special seals for special jobs, installation precautions and techniques, tips on trouble-shooting. These, and many more hard facts about oil seal engineering.

We suggest you clip and save these pages as they appear. You'll find they form a comprehensive notebook of oil seal information.

NATIONAL
OIL AND FLUID SEALS ®

1544





Which Coupling Shall I Use?

Here are four types of BOSTON couplings suitable for a wide range of applications from "flea" power up to 100 horsepower—available in 69 different stock sizes!

1 This is what is known as the Renold-Hardy flexible coupling and is made up of a flexible disc. of vulcanized rubbered fabric inserted between two metal flanges with hubs. It is available in various sizes capable of transmitting from 1 horsepower up to 100 horsepower.

2 This coupling is known as BOSTON type "FCN"—a three-jaw coupling and is made of a high grade, low carbon content steel with a non-metallic cushion between the jaws to absorb vibration or shocks. It is available in bore sizes ranging from 3/8″ to 1½″ diameter.

3 This coupling is known as BOSTON type "FA"—a multi-jaw coupling and is made of untreated steel. This coupling is particularly well suited for use with small displays or other light duty applications. It is available in bore sizes ranging from 3/16″ to ½″ diameter.

4 This coupling is known as BOSTON type "FCB"—a special ball bearing type flexible coupling and is made of case-hardened steel with an insert having hardened and ground steel balls. The greater flexibility of this coupling over an ordinary jaw coupling removes the strain between motor and machine, permitting unrestricted end play of motor shaft. It is available in bore sizes ranging from 3/8″ to 1½″ diameter.

One of the main features of these couplings is that practically all 69 sizes are carried in stock ready for immediate delivery. Send for your copy of Boston Gear Catalog 54 listing these 69 couplings as well as all other Boston Power Transmission Equipment and Component Machine Parts.

BOSTON GEAR WORKS • INC.
NORTH QUINCY 71, MASSACHUSETTS

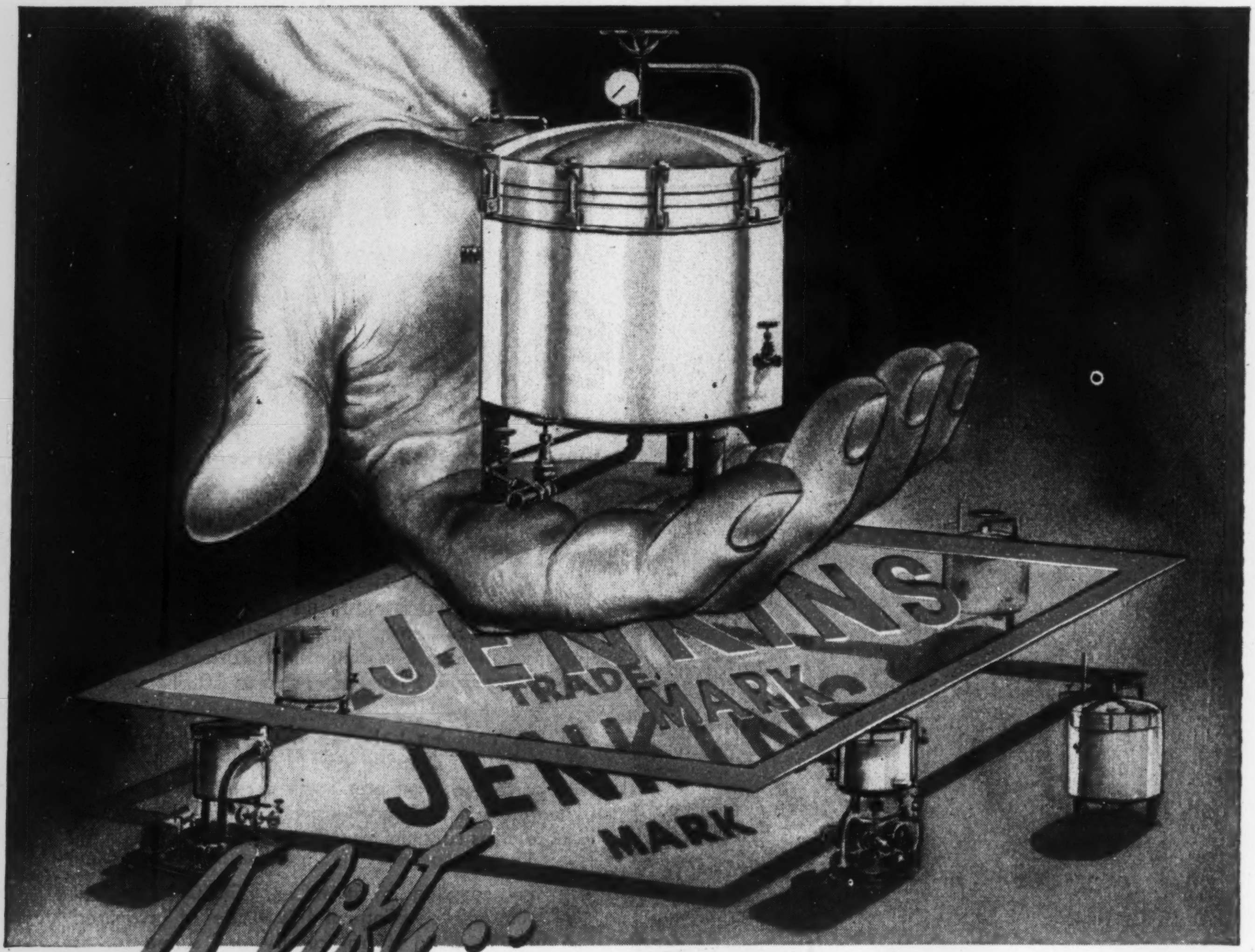
GENTLEMEN: Please send me_______copies of Boston Gear General Catalog 54 containing complete specifications and list prices of your couplings and all other Boston Power Transmission Equipment and Component Machine Parts.

NAME______________________________

COMPANY____________________________

STREET_____________________________

CITY________________ZONE_____STATE_______



A lift . . ABOVE COMPETITION FOR VALVE-EQUIPPED PRODUCTS

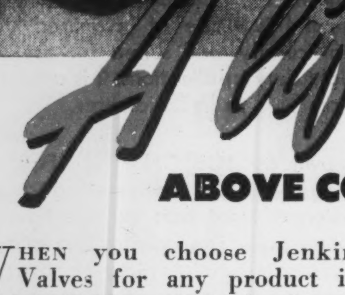
When you choose Jenkins Valves for any product involving fluid control, the famous Diamond and Signature trade mark becomes an important asset to your sales force.

It saves them valuable time and selling effort because any prospective customer *knows* Jenkins Valves — *knows* of their 83-year reputation for trouble-free performance. He has seen them in use on all types of products made by America's leading manufacturers. He has also seen Jenkins continuous, industry-wide advertising.

The Jenkins trade mark signifies to your prospects, not only good valves, but good construction throughout your product, because he credits you with equal care in the choice of other components of your product.

Jenkins Engineers are ready to work with you on any problem of selection and application. For general valve information, keyed to your needs, get the Jenkins Designers' Kit. Give your product, and its purchasers, the *extra value* of Jenkins Valves . . . *it costs no more.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.



GET JENKINS DESIGNERS' KIT. A handy file of valve information needed by product development men . . . helps answer the question — "Which type of valve where for best performance?" Mail the coupon.

JENKINS BROS., 80 White St., New York 13

Please send me the Jenkins Designers' Kit.

Name ....

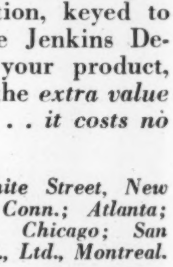
Company ....

Address ....

LOOK FOR THIS DIAMOND MARK

SINCE *Jenkins Bros* 1864

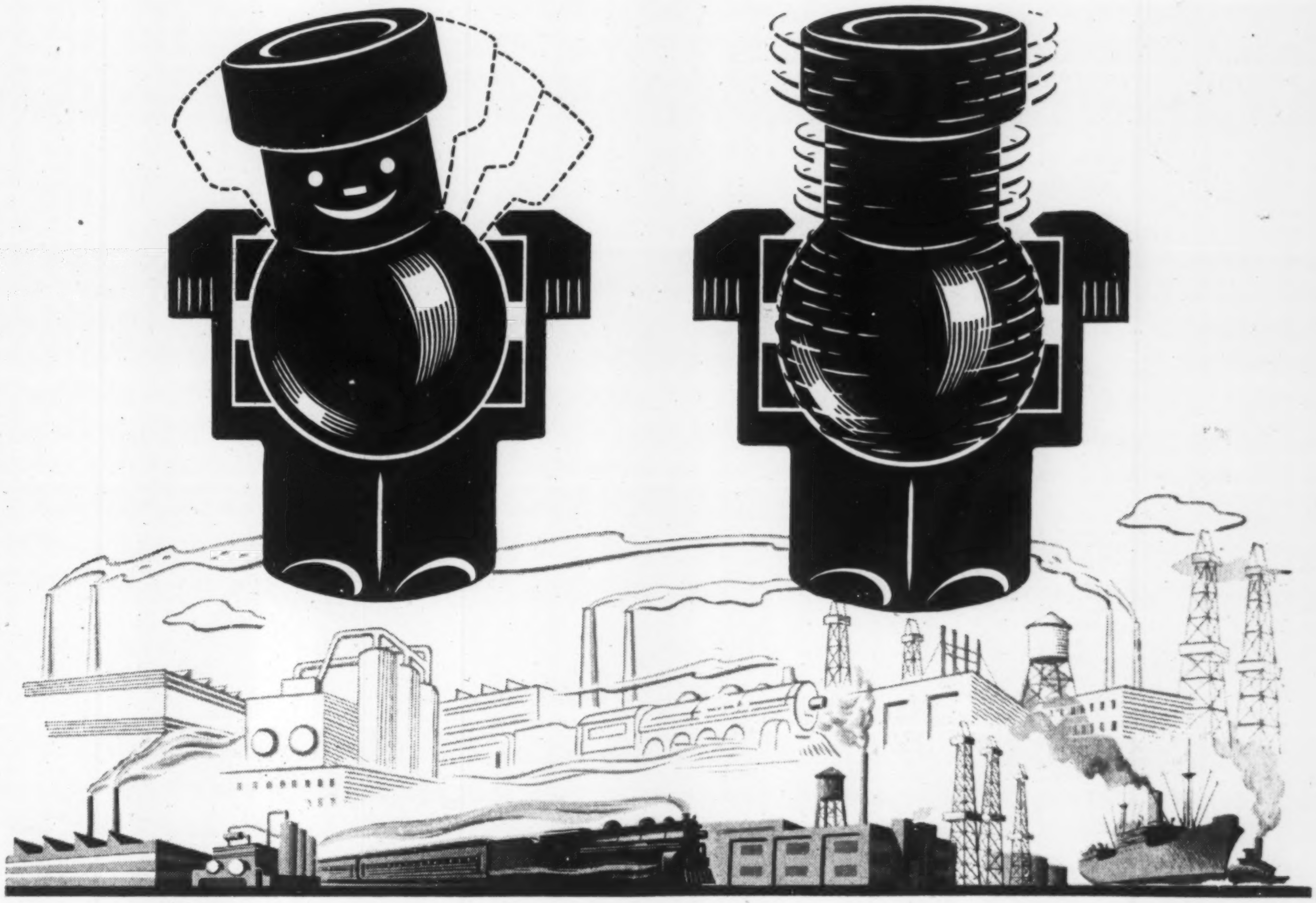
JENKINS VALVES



Types, Sizes, Pressures, Metals for Every Need

WE'RE STILL WORKING

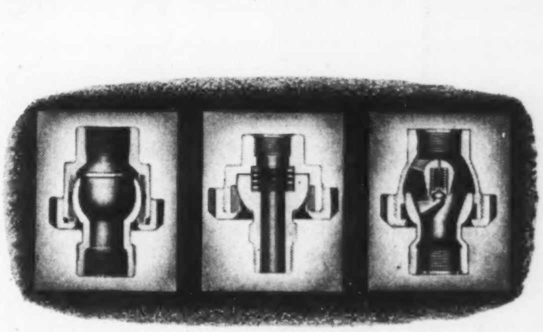
THE 7-DAY WEEK



A short work week for Barco Joints? Well hardly! The truth is that the job Barco Joints have to do takes 24 hours a day, 7 days a week. It's an old-fashioned idea—*but Barco Joints work all the time*—and the companies that use them love it.

For these joints are never "problem children," either. Applied to a fluid conveyor or feed line, they work continuously, being unbothered by pressure, change of direction or strain of any kind. They're tough and efficient. They soak up shock through their exclusive combination of ball and swivel action.

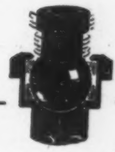
Nope—Barco Joints are *not* 1947 tenderfeet—but they fit perfectly into 1947 engineering. For complete information and engineering data, write to Barco Manufacturing Company, Not Inc., 1806 Winnemac Avenue, Chicago 40, Illinois. In Canada: The Holden Co., Ltd., Montreal, Canada.



BARCO FLEXIBLE JOINTS

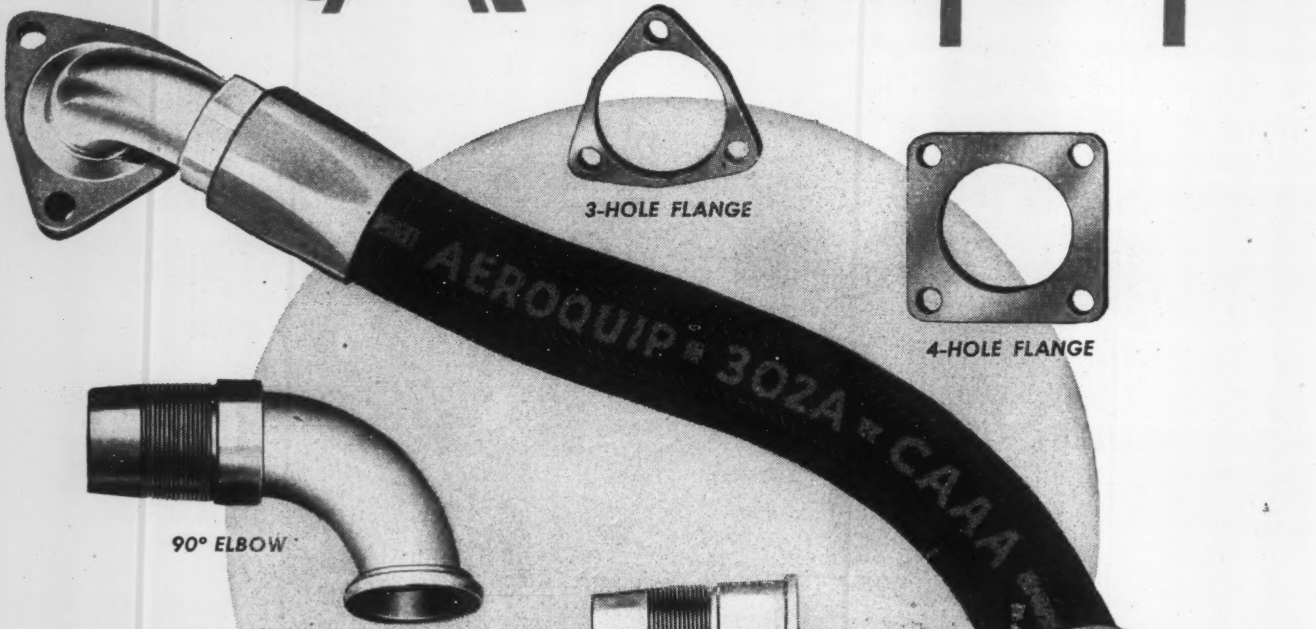
Not just a swivel joint ...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY



"MOVE IN EVERY DIRECTION"

Aeroquip



AEROQUIP *FLANGE-TYPE* HOSE LINES*

A development to reduce weight, allow more flexibility in power plant and to reduce fire hazard.

Three-piece fitting, each individual part replaceable. Assembly without special tools. No adjustment or tightening after assembly. Fittings can be removed from hose and reused over 100 times.

Specify these new assemblies for lower cost, more safety, and easy maintenance.

Aeroquip for better performance, maintenance, and service.

AEROQUIP FIRSTS

Self-Sealing Couplings

Detachable Hose Fittings

Hydrofuse

Hydrauliscope

*** Another Aeroquip First**

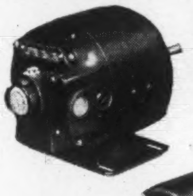
AEROQUIP CORPORATION

JACKSON, MICHIGAN

303 WAREHAM BLDG., HAGERSTOWN, MD. • 327 M & M BUILDING, HOUSTON 2 • 1709 W. 8TH ST., LOS ANGELES 14 • 803 PENCE BUILDING, MINNEAPOLIS 3

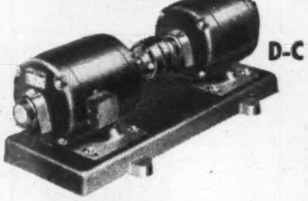
Once Again General Electric Offers *Short Deliveries*

On D-C FHP Motors and Generators



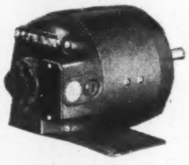
GENERAL-PURPOSE D-C MOTORS

Designed for general-purpose applications. Often used with a-c and d-c conversion equipment. Gives you quiet operation. Comes in wide range of horsepower ratings and speeds.



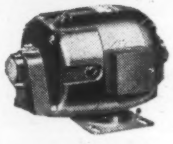
D-C GENERATORS AND MOTOR-GENERATOR SETS

Recommended as d-c power unit for industrial devices or as exciters for large equipment. Available in output ratings of 125, 250, and 500 watts continuous duty; 125 and 250 d-c volts.



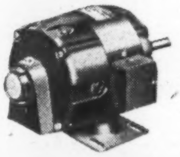
LOW-VOLTAGE SPECIAL D-C MOTORS

Operate from power sources commonly used on busses, trucks, railroad equipment, battery-operated industrial trucks, etc. Sturdy adaptable motors, built usually from general-purpose motor parts.



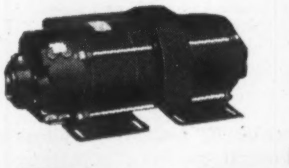
DYNAMOTORS

Give you reliable means of converting d-c power to other voltages, or to a-c. Recommended for neon signs, locomotive headlights, communication equipment, etc. A light but sturdy unit.



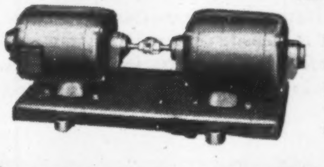
A-C GENERATORS

Offer you effective source of a-c current for places where it otherwise would be unobtainable. Available in standard ratings. Strong, well constructed power units.



MOTOR AMPLIDYNE-GENERATOR SETS AND AMPLIDYNE GENERATORS

Give unusually quick response over a wide range of operating loads. Thus, the amplidyne generators are suitable for many applications. Available in single units or assembled with motor drive.



HIGH-FREQUENCY MOTOR ALTERNATORS

Highly recommended for testing equipment and source of power supply for high-frequency machines. Small and lightweight units, but sturdy and hard-working.

It has been a long time since we have talked about short deliveries on fractional-horsepower motors. But our engineering and manufacturing facilities are now available to give you just that on d-c fhp motors, generators, and motor-generator sets. Whether you require a few motors or many, we are ready to help you.

Available for quick short deliveries are general-purpose d-c motors, d-c generators and motor-generator sets, low-voltage special d-c motors, dynamotors, a-c generators, motor amplidyne-generator sets and amplidyne generators, and high frequency motor alternators.

These equipments have a variety of applications. Our staff of experienced fractional-horsepower motor engineers can help you with design and application problems. These men accumulated a vast store of new "know how" from thousands of war jobs. Combine this with previous accumulation of design knowledge and application experience, and you have 46 years of experience at your service.

Whether it is a new or old application, we can help you. Save you time and money, too! For more information on the kinds of equipments we can offer you for quick delivery, write for GEA-4871, or call your nearest G-E office.

Mail This Coupon For Bulletin Describing Available D-c, Fhp Equipments

General Electric Company
Apparatus Dept., Section F 700-84
Schenectady 5, N. Y.

Please send me bulletin, GEA-4871, which describes G-E d-c fractional-horsepower motors and generators available for short delivery.

Name..

Company..

Street..

City.. State..................

GENERAL ELECTRIC

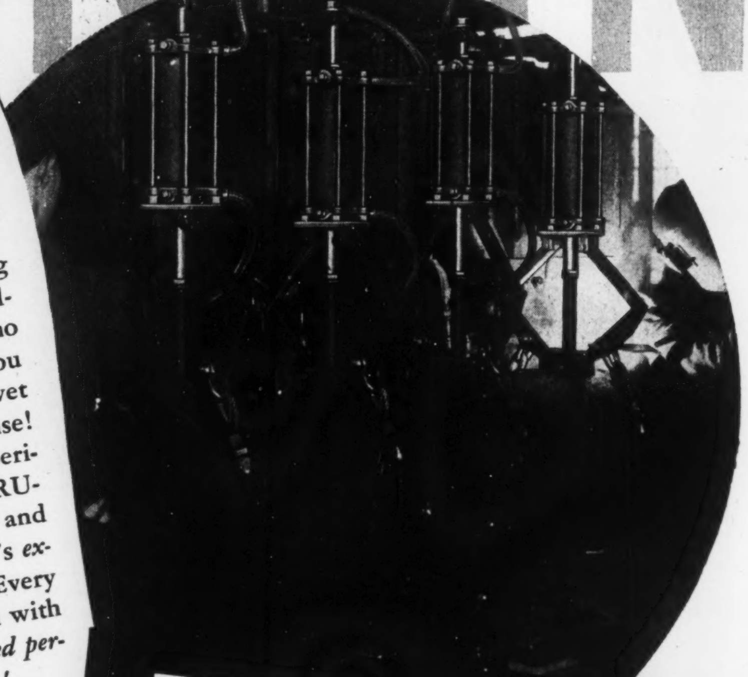
700-84

HANNIFIN

No Question ABOUT PERFORMANCE!

ONE of the big advantages of using Hannifin Standardized Pneumatic Cylinders is that you know there will be no question about PERFORMANCE. You get the kind of action you want: velvet smooth...full power...instant response!

There is a reason for Hannifin's superiority. Every Hannifin cylinder is TRU-BORED from steel cylinder stock and honed to a satin finish by Hannifin's exclusive long stroke honing process. Every Hannifin cylinder is manufactured with precision tooling. *For unquestioned performance, standardize on Hannifin!*



PNEUMATIC *Standardized* CYLINDERS

Many Different Models!

The Hannifin line of pneumatic cylinders is complete. For quicker delivery and maximum economy, you can meet virtually any requirement with a standard Hannifin precision-built cylinder:

—Ten standard bore diameters to choose from, ranging from 1 inch to 12 inch.
—Six basic mounting styles. Also available in double end styles.
—Any stroke you specify. Double acting or single acting.
—With or without adjustable cushioning for head cap...rod cap...or both.

For the complete story, ask for a copy of Hannifin Bulletin No. 57-M.

SERIES "LW"—Hannifin Series "LW" Pneumatic Cylinders, featuring cup type piston packing, are preferred by many experienced engineers for their simplicity... economy... smooth operation. Series "LW" cylinders are available in small bore sizes from 1" to 2½" and also in standard range of sizes from 3" to 12".

Tru HONED *Bored*

SERIES "R"—Series "R" *Leakproof* Cylinders feature the exclusive external packing adjustment design developed by Hannifin for positive assurance against air leakage and increased convenience in maintenance. Unexcelled for freedom from friction and high sustained efficiency. Built in standard range of sizes from 3" to 12."

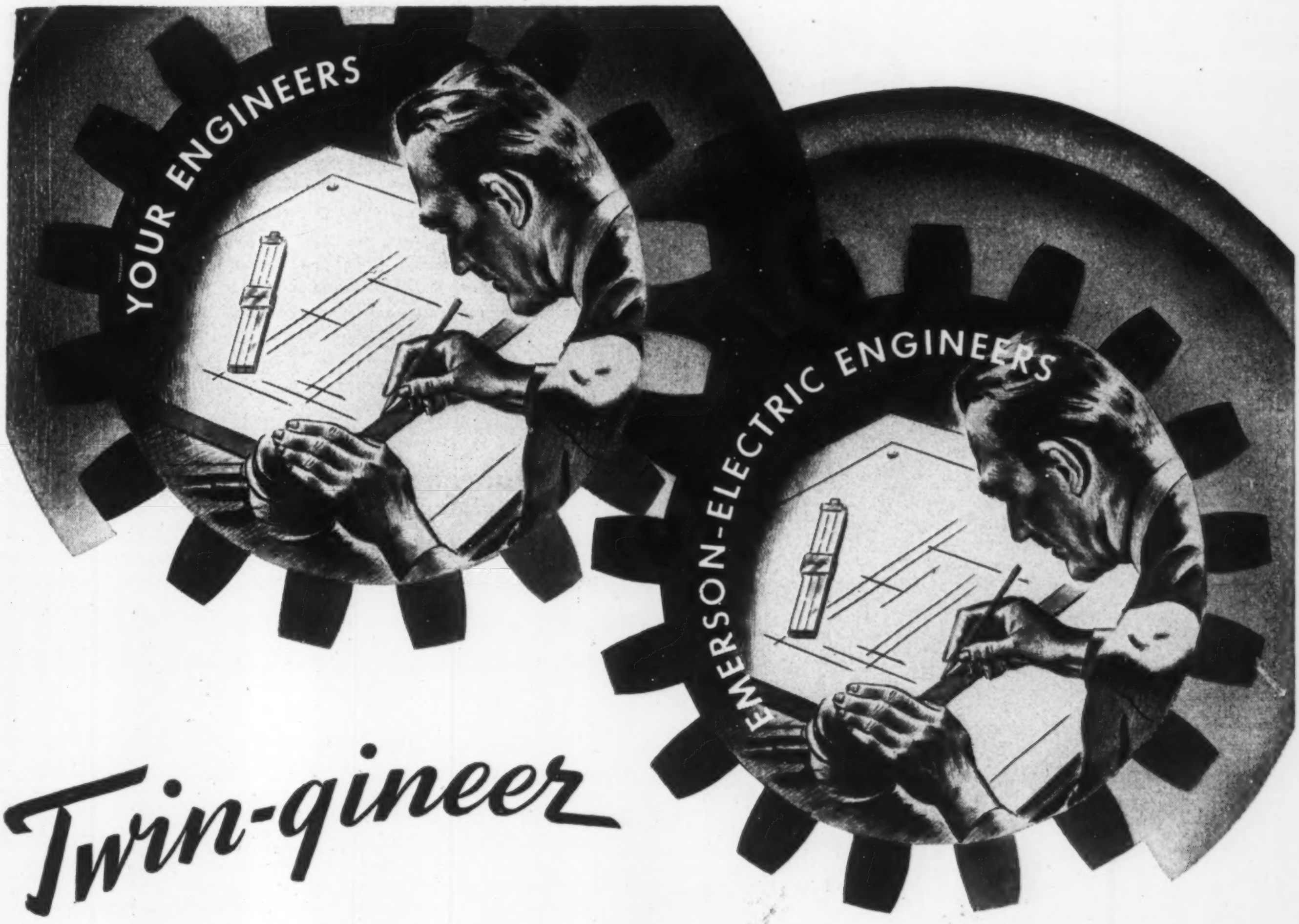
HANNIFIN

Nationwide Sales and Service

HANNIFIN CORPORATION

1101 So. Kilbourn Ave., Chicago 24, Ill.

AIR CYLINDERS • HYDRAULIC CYLINDERS • HYDRAULIC PRESSES
PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES



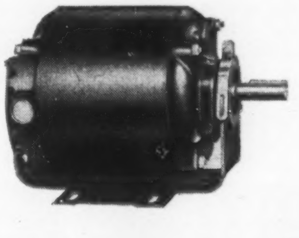
Twin-gineer

Your New Product for MARKET SUCCESS

To achieve top performance and top sales for your new or improved motor-driven appliance, mesh your own experience in design with the 57 years of engineering experience behind Emerson-Electric.

Such *meshing*—"Twin-gineering" we call it—may also help you save costly engineering back-tracking, may suggest many manufacturing short cuts.

Emerson-Electric engineers are now at your service, ready and able to gear their engineering ideas, experience and skill to your own in designing and producing market stand-outs in the motor-driven appliance field.



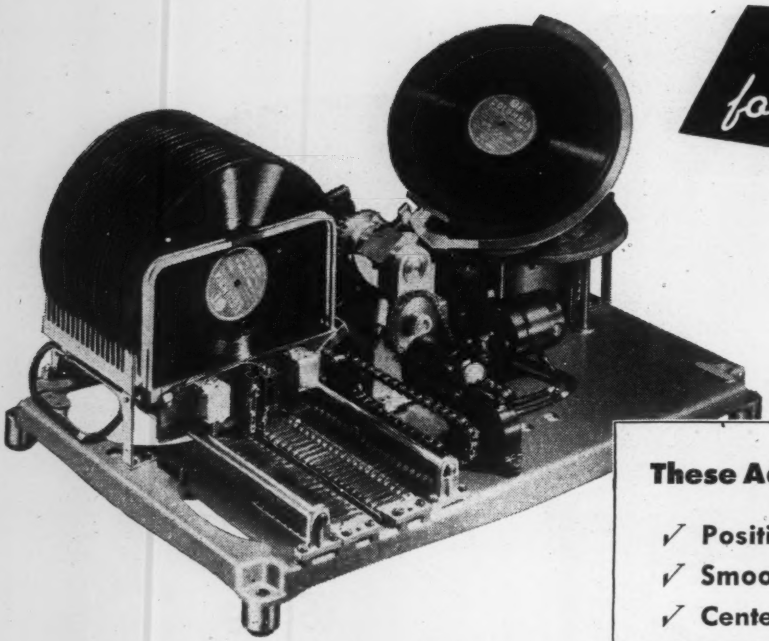
Emerson-Electric Motors
1/20 to 5 H. P.—AC and DC

To add this vital cog to your own business machine, get in touch with Emerson-Electric TODAY!

THE EMERSON ELECTRIC MFG. CO.
St. Louis 21, Mo.
Branches: New York • Chicago • Cincinnati
Detroit • Los Angeles • Davenport 54

EMERSON EMERSON ELECTRIC **ELECTRIC**

MOTORS · FANS APPLIANCES

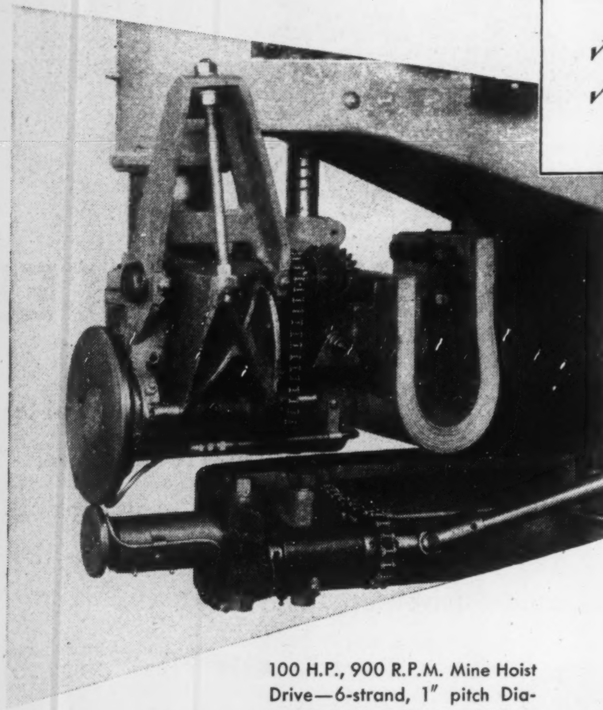


Dependable Drives for Different Purposes

Two Diamond Drives on Record Changer Equipment—an example of good application engineering. The uniformity of chain quality assures long-life precision.

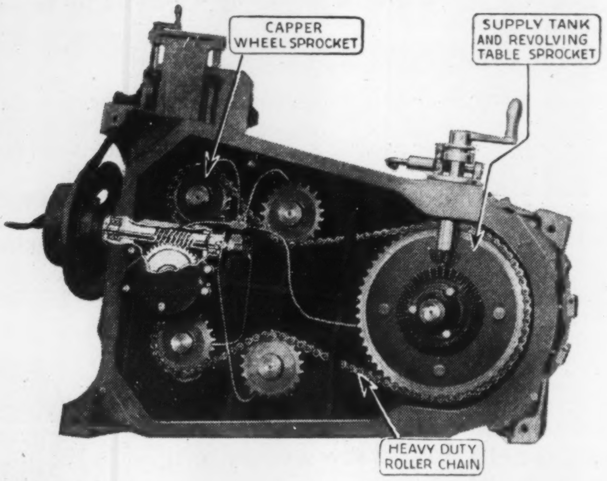
These Advantages Aid in Machine Design

- ✓ Positive as gears.
- ✓ Smooth—quiet—compact.
- ✓ Center distances no factor.
- ✓ Load spread over many sprocket teeth not on one tooth contact.
- ✓ Wide range of pitch sizes—1/4" to 2 1/2".
- ✓ Wide range of capacities—fractional to several thousand H.P.

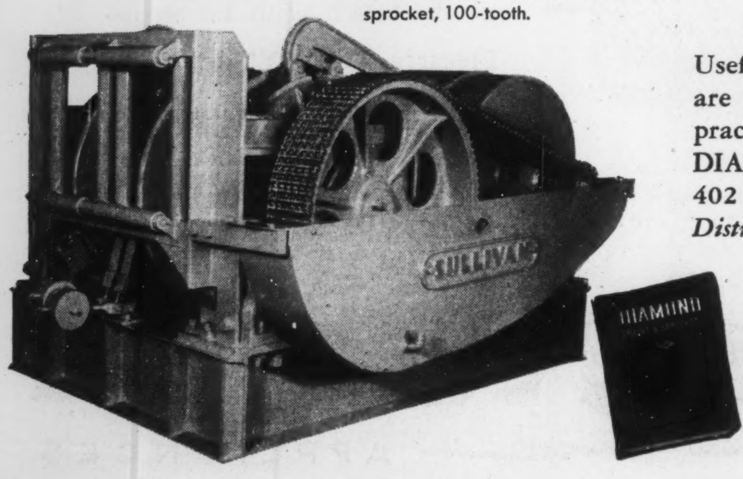


At left: On this Seam Welder showing Diamond Roller Chain Drives operating horns. Simple, sure, positive operation.

Below: On the Filling Machine, Diamond Roller Chain answers well the problem of multiple-shaft drive.



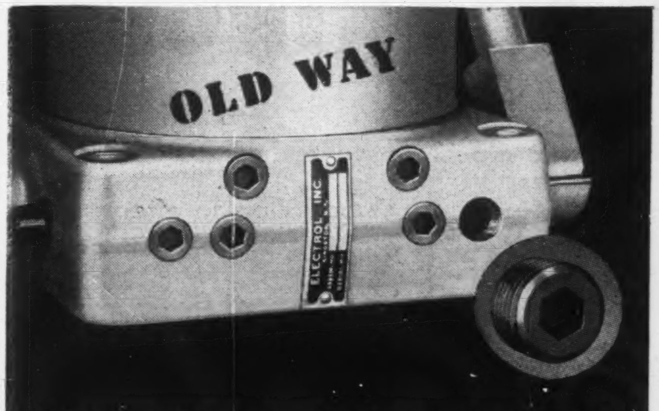
100 H.P., 900 R.P.M. Mine Hoist Drive—6-strand, 1" pitch Diamond Roller Chain. Driver sprocket, 18-tooth; driven sprocket, 100-tooth.



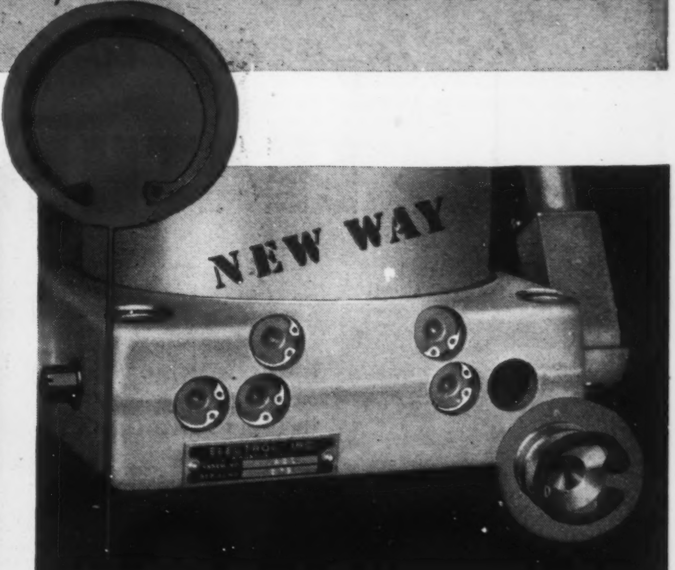
Useful data on drive applications and chain selections are contained in Catalog 617. A copy along with practical suggestions are yours for the asking . . . DIAMOND CHAIN COMPANY, Inc., Dept. 435, 402 Kentucky Ave., Indianapolis 7, Ind. *Offices and Distributors in all Principal Cities.*

DIAMOND ROLLER CHAINS

Redesign eliminates 12 operations, reduces Unit Cost 65 cents



ELECTROL POWERPAK: A complete hydraulic power system used for controlling flaps and landing gear in aircraft—originally confined fluid with threaded pipe plugs. Result—expensive sealing.



NEW DESIGN: Waldes Truarc rings provide positive seal up to 3000 P.S.I. for plugs without threads. Changeover eliminated two milling, ten tapping operations. Result—inexpensive sealing.

Redesign with Waldes Truarc rings not only saved us 65 cents a unit and 6¼ minutes production time, it made a more compact and finer product—reports Electrol, Inc., of Kingston, N. Y. Truarc helped cut 4 ounces a unit, eliminated milling and tapping, allowed switching from skilled to semi-skilled labor. Maintenance was cut more than a half.

Redesign with Truarc, and you will cut costs and increase production, too. Wherever you use machined shoulders, nuts, bolts, snap rings, cotter pins—there's a Truarc ring that does a better job of holding parts together. All Waldes Truarc retaining rings are precision engineered, easy to assemble and disassemble, always circular to give a never-failing grip. They can be used over and over again. Send us your problem. Waldes Truarc engineers will be glad to show how Truarc can help you.

15 Waldes Truarc Retaining Rings effect these Savings

	SAVING
• Eliminate 2 milling operations	$.10
• Replace 10 tapping operations with grooves	.15
• Increase accuracy of mating parts	.03
• Replace pipe plugs with plugs made in automatics	.16
• Cut plug assembly time over 50%	.15
• Reduce production test time	.06
Total savings per unit	**$.65**

WALDES
TRUARC
U. S. PATENT RE. 18,144
RETAINING RINGS
WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK
Canadian Rep.. Controlite Engineering & Sales Ltd., 20 Bloor Street W., Toronto 5

New Development In Retaining Rings

• *Send for new Truarc booklet, "New Development In Retaining Rings"*

Waldes Kohinoor, Inc., 47-10 Austel Place 21-1
Long Island City 1, N. Y.

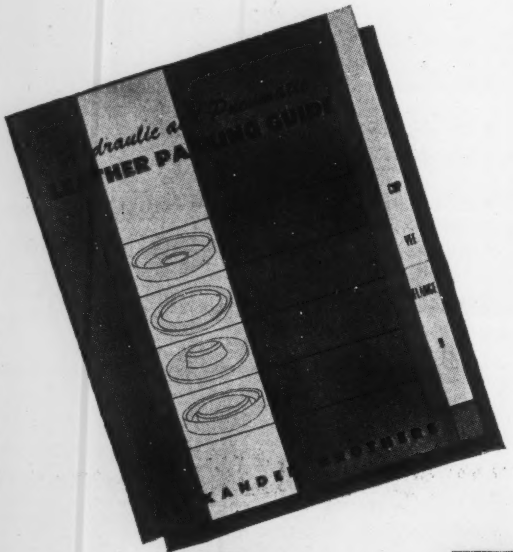
Please send booklet, "New Development In Retaining Rings" to:

Name__________
Title__________
Company__________
Business Address__________
City__________Zone______State______

The Information You Vitally Need about LEATHER PACKINGS

Many hydraulic and pneumatic machines have disappointed their designers solely because faulty packings failed to effectively seal the pressure medium.

The Alexander Consultant Service offers the specific knowledge and wide experience of Leather Packing specialists who welcome your packing problems. They will gladly discuss with you the important relation of packing efficiency to machine design. This Alexander service is FREE. Use it, by all means, whether in regard to machinery now in use or just being designed or re-designed.



The Leather Packing Guide discusses at length, with comprehensive illustrations, everything you should know about CUP, VEE, Flange and "U" leather packings and kindred subjects, giving valuable standard specifications and formulas, and information about Alexander special tannages for various out-of-the-ordinary jobs. Send for your FREE copy.

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ALEXANDER BROTHERS
406 N. Third Street, Philadelphia 23, Pa.

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5 FEET
3 FEET 2 IN.
Now two machines operate in space formerly required for one

Dayton Multiple V-Belt Drive Licks Space Problem

Here is one of the latest model vertical air compressors specifically designed for continuous, heavy-duty, 24-hour per day service. One of its chief advantages is the small floor space it requires. Yet its efficiency demands consistent, dependable power. To develop the power needed, the designer specified a Dayton V-Belt Drive.

This is another outstanding example of the flexibility of Dayton V-Belt Drives. And the ability of Dayton V-Belts to perform in excess of standard requirements under all operating conditions . . . unaffected by dust, oil, heat, liquids . . . is another of the many reasons why more industrial designers consistently specify Daytons for original equipment.

A Dayton Power Transmission Specialist is ready to help you. Call or write:

DAYTON RUBBER • DAYTON, OHIO

NOW! *Rayon Cords

PROVIDE DAYTON V-BELTS WITH

1. Minimum Stretch 2. Greater Flex Strength
3. Longer V-Belt Life

* Rayon cords are *specially processed* by Dayton for use in V-Belts to provide the most efficient and economical power transmission service for your machine needs. For the complete story write for booklet A-469.

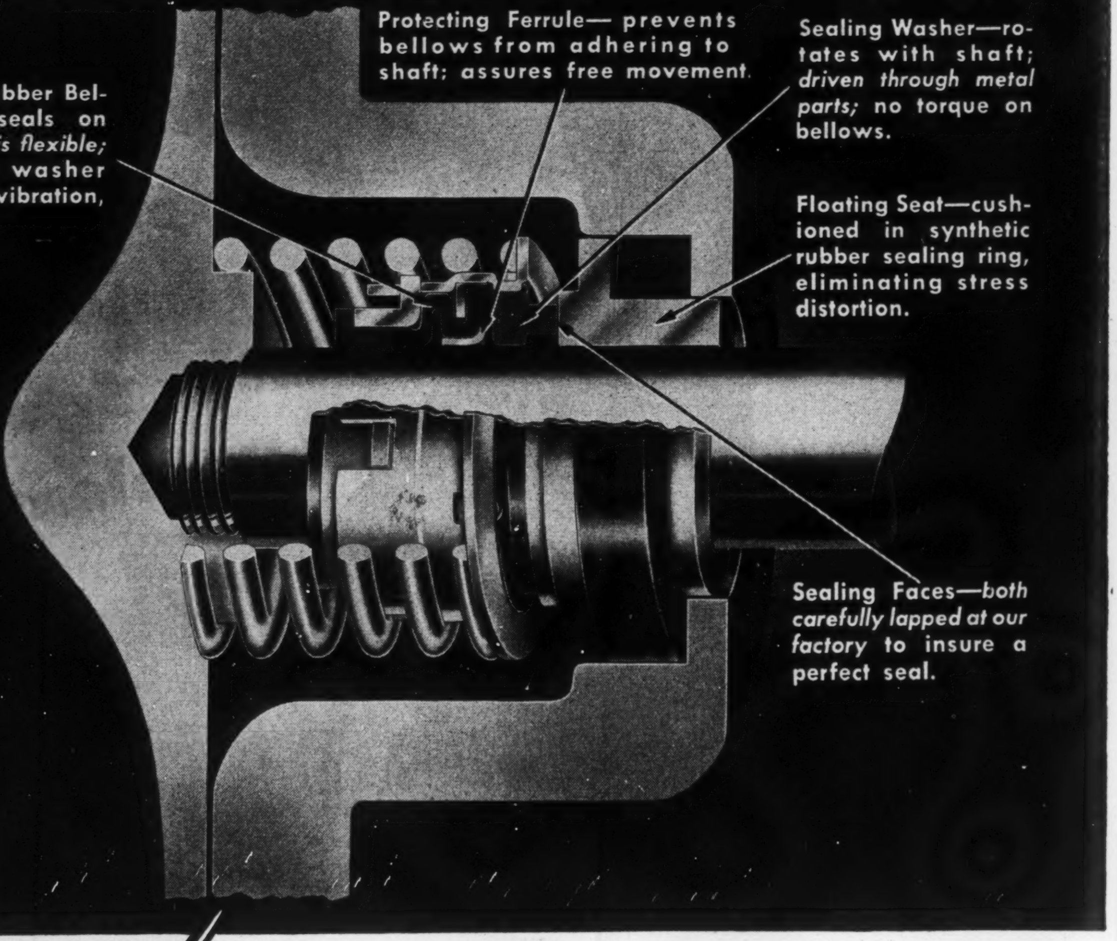
POWER
Dayton
V-BELT DRIVES

Dayton Rubber

THE MARK OF TECHNICAL EXCELLENCE IN NATURAL AND SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

5 OUTSTANDING *Features*



Synthetic Rubber Bellows—tail seals on shaft. *Head is flexible;* adjusts for washer wear, shaft vibration, end play.

Protecting Ferrule— prevents bellows from adhering to shaft: assures free movement.

Sealing Washer—rotates with shaft; *driven through metal parts;* no torque on bellows.

Floating Seat—cushioned in synthetic rubber sealing ring, eliminating stress distortion.

Sealing Faces—*both carefully lapped at our factory* to insure a perfect seal.

of the JOHN CRANE BELLOWS-TYPE *Shaft Seal*

This is a new, precision-built Shaft Seal already thoroughly proven on Centrifugal and Rotary Pumps, Speed Reducers, Refrigeration Compressors, Agitator Shafts and many other rotating shaft sealing applications.

Advantages:

- ***Eliminates leakage, gland adjustment and shaft wear***
- ***Reduces friction, saves power***
- ***Operates effectively at high speeds and pressures***
- ***Shipped as a complete unit, ready for installation***

The John Crane Bellows-Type Shaft Seal is made in two types: Type 1 for limited diameter; Type 11 (illustrated above) for limited length.

Design and Development Engineers—Send for Illustrated Bulletin

CRANE PACKING COMPANY

1825 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

skilled springmakers.. AND practical, experienced engineers, *SPECIALISTS* in spring design and manufacture

At Accurate

It takes people to make springs. Ours are specialized, highly trained, long-experienced people—well qualified to give you the finest in spring craftsmanship.

¶ Our engineers too, are an important reason why you'll like Accurate Spring Service. They're old hands at spring-making... they've developed manufacturing systems and procedures that enable us to handle your jobs with the greatest speed and efficiency. These Accurate engineers are at your service on spring design problems. You will benefit from their practical assistance in designing exactly the right spring for your application.

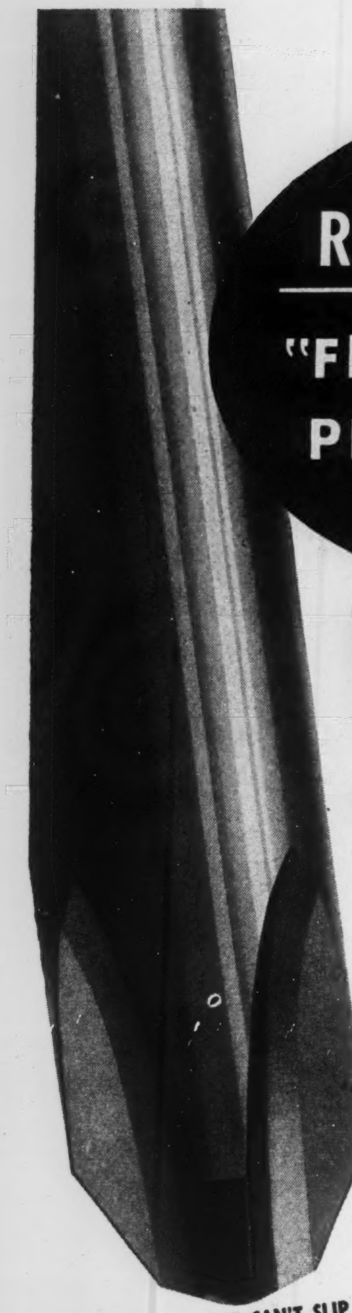
¶ Why not try Accurate on your next job.

Send for your copy of the new Accurate Spring Handbook. It's full of data and formulae which you will find useful. No obligation of course.

ACCURATE SPRING MFG. CO.
3813 W. Lake Street Chicago 24, Illinois

Accurate Springs

SPRINGS • WIREFORMS • STAMPINGS



R. R. Car Builders

"Flag" AMERICAN PHILLIPS Screws

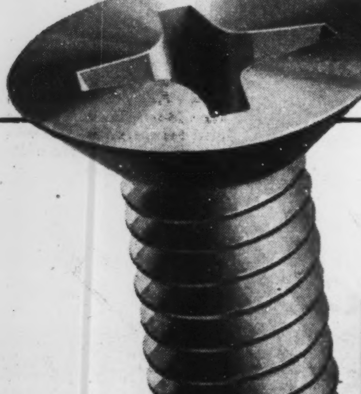
for "Express Train" Assembly Speeds __that__ __Cut__ __Costs__
for Streamlined Looks __that__ __Sell__ __Customers__*

"HIGHBALL" PRODUCTION — "Highball's" the railroad term for *get moving*—and that's just what you do when fumble-proof, power-driven American Phillips Screws take over! Whether you make streamliners, appliances, radios or what not, American Phillips Screws can't slip off "the track" to harm work or worker—and there isn't a burred screw head in a carload. This *automatic,* speedy driving of engineered screws *ups* production schedules while gaining time-savings as high as 50%!

"HIGHBALL" PROMOTION — Smart, sleek, streamlined American Phillips Screws tell a quality story FAST—are a modern complement to high-style products. They can't snag hose or clothes. And more and more buyers spot them as a tip-off to solid construction and longer service. Whether you sell industry or the consumer, get the facts on the DOUBLE advantages (in production and promotion) provided by American Phillips Screws.

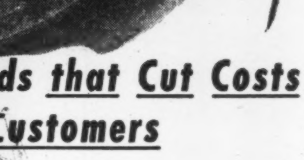
*The railroads *and* the public.

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS



AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND
Chicago 11: 589 E. Illinois Street *Detroit 2:* 502 Stephenson Building

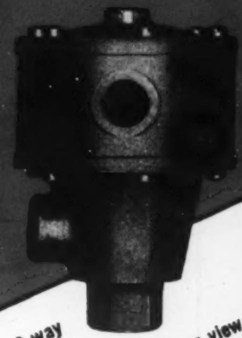
AMERICAN PHILLIPS *Screws*



ALL TYPES
ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

Quick-As-Wink

CONTROL VALVES

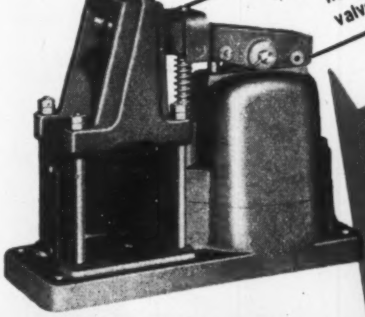


Available in 2-way
3-way
4-way
types

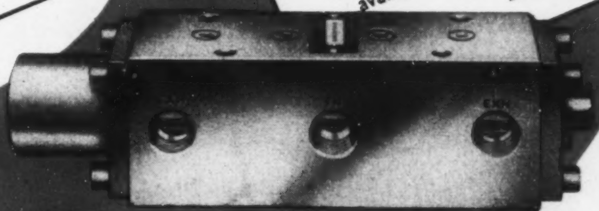
Exterior view of 2- and 3-way diaphragm valve.

1/2" 4-way neutral position hydraulic valve. Hydraulic valves in pressures up to and including **5000 lbs.**

HAND
FOOT
CAM
DIAPHRAGM
PILOT CYLINDER
SOLENOID
} **OPERATED**



1/2" 3-way, single solenoid, spring return valve.



1/2" 4-way mechanically operated, spring return valve. Air valves are available in pressures up to **250 lbs.**

C. B. HUNT & SON, INC., SALEM, OHIO

THE HIGHER THE PRESSURE THE TIGHTER THE SEAL
AIR
WATER
OIL

simplify THE APPLICATION OF HYDRAULIC ACTUATION TO ANY ONE OF THESE 4* PRODUCTS . . . .

ROAD MACHINERY

Where you need a compact economical unit for operations, such as positioning a blade, you'll find it in the elements listed below.

MATERIALS HANDLING EQUIP.

For fast snappy action in moving heavy loads quickly, and, accurate control for lifting to required heights, you'll find an economical solution in the Sundstrand standard hydraulic elements.

PACKAGING MACHINERY

You'll get variable speed control, accurate and fast control of movements and consistently accurate duplication of movement with the proper combination of standard Sundstrand hydraulic elements.

MACHINE TOOLS

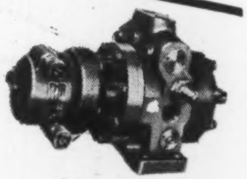
Effective speed and feed controls and consistently accurate clamping pressures can both be obtained easily from a simple Sundstrand hydraulic circuit. Here, again, in the standard elements, illustrated below, you'll find what you need for better designing.

** Sundstrand hydraulic elements are widely used in hydraulic circuits in many similar products.*

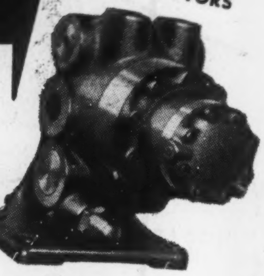
. . . WITH THESE STANDARD SUNDSTRAND ELEMENTS

Yes, hydraulic circuits designed with the proper combination of these standard Sundstrand elements offers the best solution to your hydraulic equipment design problems. Proper combinations and circuit design are arrived at through design conferences between you and our hydraulic application engineers . . . When designing new equipment or redesigning present models, call in a Sundstrand hydraulic application engineer. He will suggest the best combination of these hydraulic elements to meet your design requirements . . . There is no obligation for this service.

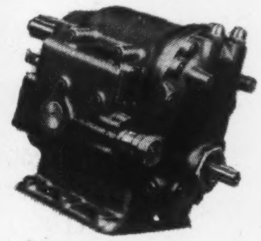
FLUID MOTORS



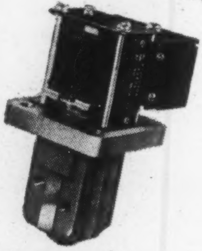
PUMPS



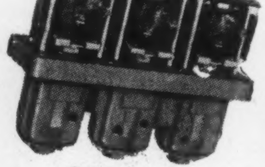
CLAMPING PUMPS



TRANSMISSIONS



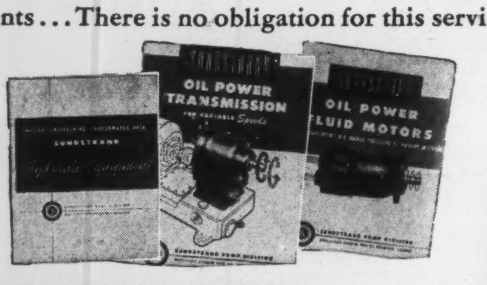
SINGLE SOLENOID VALVES



TRIPLE SOLENOID VALVES

FOUR-WAY VALVES

LUBRICATING PUMPS



FREE ADDITIONAL DATA is included in this set of bulletins. Write for your copies today. Ask for bulletin M-21

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS U.S.A.

SUNDSTRAND PUMP DIVISION

2559 ELEVENTH STREET • ROCKFORD, ILLINOIS

FUEL UNITS • HYDRAULIC PUMPS • TRANSMISSIONS • FLUID MOTORS • VALVES and CONTROLS

the right Answer to your fastening problems

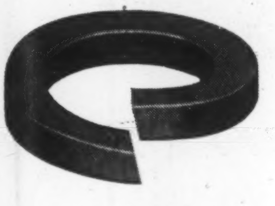
IS VITAL TO THE SERVICEABILITY OF YOUR PRODUCT

There is a Reliance Spring Lock Washer designed to successfully cope with every type of assembly condition. The right spring lock washer to solve *your* fastening problem can be found among the wide selection which makes up the Reliance line.

There is real value in using a spring lock washer as a tension device which automatically compensates for inevitable looseness due to dimensional changes in a fastening assembly. This is a proven fact.

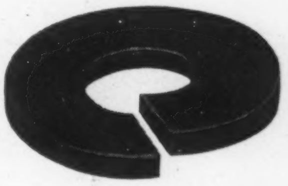
The range of reaction and the reactive tension plus its action as a hardened thrust bearing in a bolted assembled part makes a Reliance Spring Lock Washer an economical and efficient fastening device to use in protecting the serviceability of your product.

Reliance Spring Lock Washers are made in the four American Standards series: light, medium, heavy, and extra heavy. Write for samples stating type and bolt size or, better yet, have a Reliance engineer call upon you to help you solve your fastening problems.



KANTLINK

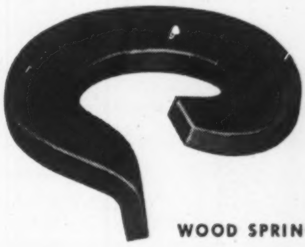
KNOLINK



WIDE BEARING

NON-LINK POSITIVE

RIBBED



WOOD SPRING

DOUBLE COIL

HY-SERVICE ROUND EDGE

SPRINGLOX

EATON SPRINGTITES

The All In-One-Unit

A Reliance Spring Lock Washer . . . preassembled on a bolt . . . or screw . . . is the modern way of using a tension device to securely and economically assemble your products. A quick method of streamlining production, eliminating waste and reducing costs.

see our CATALOG in SWEET'S FILE for PRODUCT DESIGNERS

Reliance Division

EATON

EATON MANUFACTURING COMPANY

OFFICES AND PLANT **MASSILLON, OHIO**

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

SAVE LABOR *with* T-J CYLINDERS

- ★ SIMPLIFY MACHINES
- ★ SAVE OPERATIONS
- ★ DO PUSH-PULL-LIFT JOBS

Automatically!

More and more today—industry is *saving labor* by applying T-J Air and Hydraulic Cylinders to operations of all kinds where pushing, pulling, lifting or mechanical control is needed. Available in many standard sizes and styles . . . 100 lb. or 50,000 lb. . . . both cushioned and non-cushioned types. Backed by 30 years of know-how . . . T-J engineered to do the job *better* and *cut costs!* Write today for catalogs.

The Tomkins-Johnson Company, Jackson, Mich.

FOR TOUGH JOBS SPECIFY

T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

OIL
CHEMICALS
STEAM
EXHAUST

Specify AMERICAN *Flexible* METAL HOSE & TUBING for CONVEYING...

American Flexible Metal Hose conveys a surprising variety of materials with ease of operation and economical long life. Practical on-the-job experience has taught American engineers how to develop and perfect the type of flexible metal hose best suited to each particular material and operating condition.

American Flexible *Oil* Feed Lines are used by leading manufacturers of machine tools to convey lubricants and coolants directly to the material being worked. This type "stays put" when bent into position.

In the *Chemical* field, American Flexible Metal Hose protects fine capillary tubing on sensitive recording instruments as well as carrying searching gases and fluids such as sulphur dioxide, freon, acetone, methyl chloride and caustic solutions under pressure.

American Bronze *Steam* Hose gets rough usage in handling steam under pressure for marine, industrial and general duties. American *Seamless* Flexible Metal Tubing withstands millions of flexings in carrying steam to laundry and pressing machines and such industrial machines as platen presses.

Easily-installed American *Exhaust* lines safely and effectively remove dust, chips, fatal carbon monoxide from commercial and industrial "problem spots."

These are but a few of the many applications of American Flexible Metal Hose and Tubing. When setting up new designs or starting a real money-saving maintenance campaign: PLAN ON AMERICAN.

ANACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH
General Offices: Waterbury, Conn. • Subsidiary of Anaconda Copper Mining Company
Throughout Canada: The Canadian Fairbanks-Morse Company, Limited

TURN PAGE FOR OTHER FLEXIBLE METAL HOSE APPLICATIONS ➡

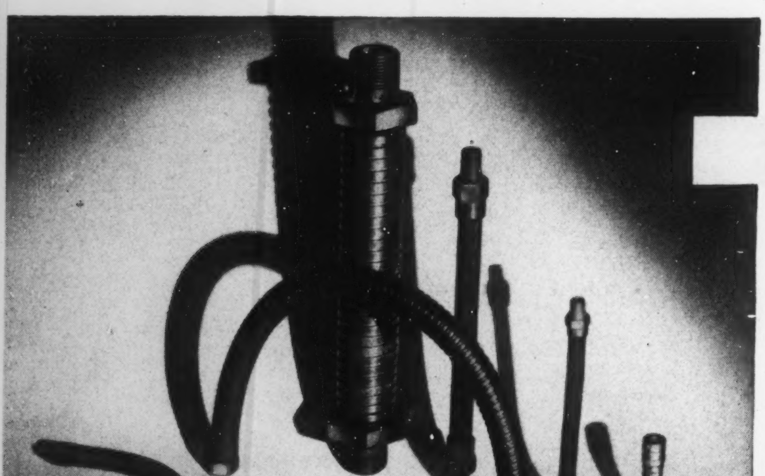
AMERICAN *Flexible* METAL HOSE & TUBING

for HEAVY and *Delicate* DUTIES

American Flexible Metal Hose is "prepared" to handle heavy requirements such as illustrated at right. In this case American Type UI Brass Refrigeration Conduit is used to cover copper refrigeration tubing to protect it against accidental damage.

American Flexible Metal Hose is equally at home on delicate duties as well as rough assignments. At right American Capillary Casing Tubing is installed on the capillary tube of a temperature element to protect the delicate tubing against damage from short bends or kinks.

Photo courtesy Penn Electric Switch Co., Goshen, Ind.



ENGINEERING *Specialties*

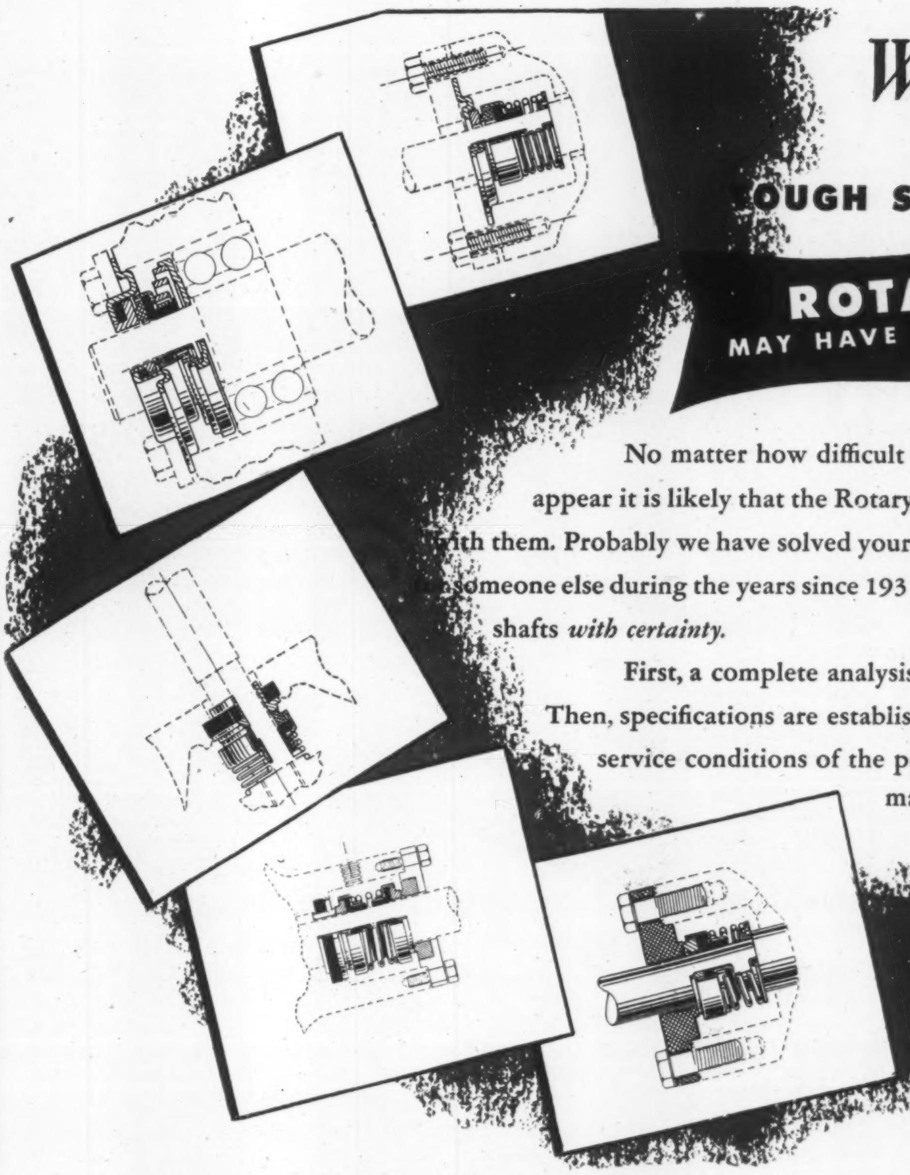
At lower left are shown some types of American Flexible Metal Hose and Tubing engineered for special duties. American Flexible Metal Hose is made in a wide variety of workable metals including: brass, bronze, steel, stainless steel, monel and aluminum — in a range of sizes from 1/8″ I.D. to 20″ I.D. — fitted with standard I.P.T. couplings or special couplings adaptable to your own needs. Our Engineering Department will be pleased to submit specific suggestions covering your flexible connector problems. Write us giving an outline of your requirements.

47289

ANACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY   AMERICAN METAL HOSE BRANCH
General Offices: Waterbury, Conn. • Subsidiary of Anaconda Copper Mining Company
Throughout Canada: The Canadian Fairbanks-Morse Company, Limited

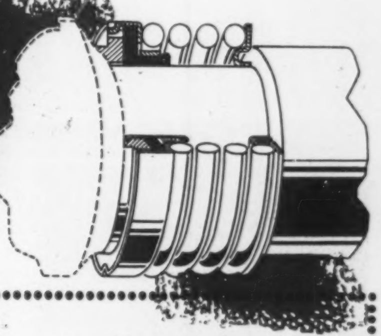


Worried ABOUT A TOUGH SEALING PROBLEM?

ROTARY SEAL MAY HAVE SOLVED IT BEFORE

No matter how difficult your shaft sealing problems may appear it is likely that the Rotary Seal Company already is familiar with them. Probably we have solved your particular problem, or problems, for someone else during the years since 1931 when we began sealing rotating shafts *with certainty.*

First, a complete analysis is made of each individual case. Then, specifications are established to fit the manufacturing and service conditions of the particular application. Samples are made up for test installation under actual operating conditions.



Rotary Seal then produces and supplies the complete seal sub-assemblies, carefully made up to the tested and approved specifications, to the manufacturer of the finished product.

The Rotary Seal method is a combination of custom engineering and precision manufacture upon which leading industrial companies throughout the country depend for fool-proof, efficient sealing of rotating shafts.

Send us your problem and let us submit a recommendation. There's no obligation. Just send complete drawings of shaft assembly and full information on operating and service conditions.

Know why a Rotary Seal is best?

The entire Seal Assembly rotates with the shaft. A running seal joint is formed by continuous, intimate contact between the rotating seal face and the mating, fixed, stationary seal seat. This contact is maintained by the pressure exerted by the coil spring. The flexible, elastic driving member, fitting frictionally tight around the shaft, acts to prevent leakage at that point. The seal face can adjust its running plane—either angularly or laterally — to compensate for shaft vibration, deflection or slight misalignment. Simplicity in design and function are basic reasons for the efficiency and practicability of the Rotary Seal principle.

Sealing
Certainty
on rotating shafts

Send for Booklet

THE mechanical seals for
ROTARY SEAL COMPANY
rotating shafts

ROTARY SEAL COMPANY, 2022 N. Larrabee Street, Chicago 14, Ill.

SPECIFY P-K AND GET . . .

GROUND THREADS

YEARS AHEAD BY EVERY TEST

IN SOCKET SET SCREWS

THREAD GRINDING, once reserved for screws used in the finest precision equipment, now gives P-K Socket Set Screws the mirror-smoothness characteristic of a ground finish—free from nicks, burrs, hardening scale and other imperfections common to cut threads. Made from hardened blanks, free from hardening distortion, uniform dependable Class 3 Fit is assured.

COMPARE! ASK FOR SAMPLES. See why P-K Ground Thread Socket Set Screws are different from ordinary set screws as night and day . . . why they will speed assemblies, improve strength and safety. You'll agree your products will benefit—assembly-wise and sales-wise! Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

AVAILABLE FOR PROMPT DELIVERY

GOOD JUDGEMENT CALLS FOR

PARKER-KALON

WHEN GOOD DESIGN CALLS FOR

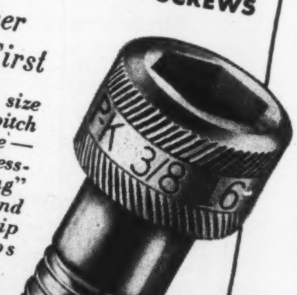
SOCKET SCREWS

SOLD ONLY
BY ACCREDITED DISTRIBUTORS

SIZE-MARKED • GEAR GRIP*
SOCKET HEAD CAP SCREWS

Another P-K First

Gives you size and thread pitch at a glance—eliminates guessing or "miking"—saves time and errors. Gear Grip prevents slips and fumbles.



*U.S. Pat. No. 126,409

WRITE FOR SAMPLES

8 Fawick Clutches
on this new 25-Ton
OHIO LOCOMOTIVE CRANE

One after another, leading manufacturers are building Fawick Clutches into their advanced new models. And there's good reason why.

Fawick Clutches have amply proved themselves under the toughest field service conditions in a wide range of applications. Time after time, they have established unequalled performance records for maximum life, trouble-free operation and minimum maintenance—on large and small machines of many types.

Let our Engineering Department give you the full facts—and their recommendations for your product.

Ohio Locomotive Crane Co., Bucyrus, Ohio, uses Fawick Air-ring Boom, Hoist, Swing and Travel Clutches on this new Model EA crane. All are complete with Fawick Quick-release Valves. Air supply to clutches is provided through Fawick Rotorseals.

FAWICK CLUTCHES WORK LIKE THIS

Compressed air expands the rubber-and-fabric gland to engage clutch, any degree of "grip" you need. Release the air and clutch disengages.

AND THESE ARE THE UNIQUE, MONEY-SAVING ADVANTAGES THAT RESULT:

- **Torque controlled, shocks absorbed by a cushion of air.**
- **No strain on any part of machine in quick starts and stops under load.**
- **No arms, levers or springs to wear or break.**
- **No adjustments to make—no lubrication required.**
- **Maintenance cost unusually low.**
- **Entire machine protected against needless loss of productive time.**

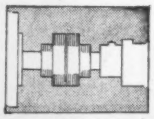
FAWICK *Airflex* and **AIRING** **CLUTCH**

FAWICK AIRFLEX CO., INC. **9919 Clinton Rd., Cleveland 11, O.**
In Canada, Renold-Coventry Ltd., Montreal, Toronto, Vancouver, Quebec • *In Britain,* Crofts Engineers, Ltd., Bradford, England

AJAX

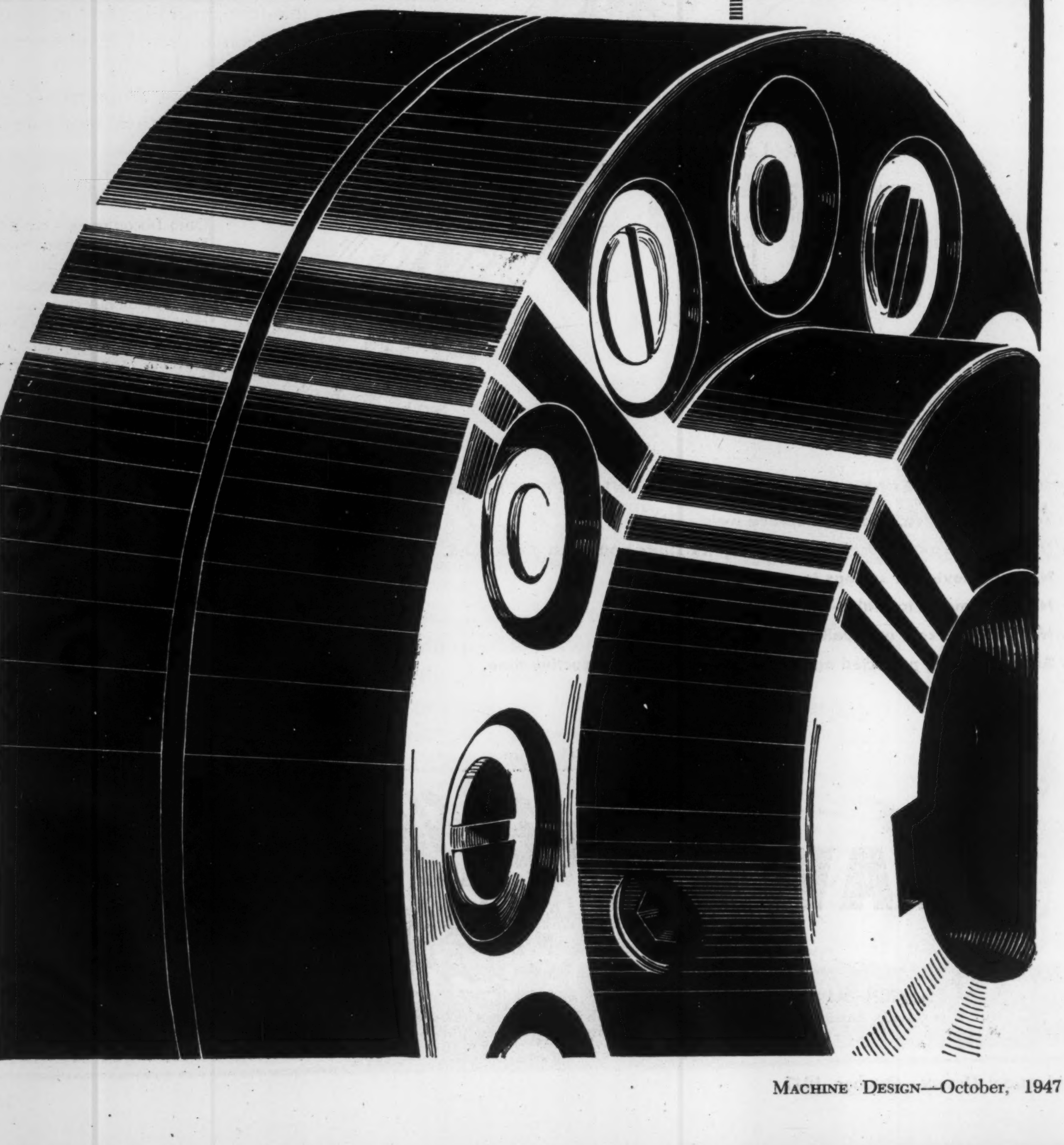
flexible COUPLINGS

Design engineers have been writing Ajax Flexible Couplings into the specifications of direct-connected machines for over 25 years. Quiet running . . . no lubrication . . . free end-float . . . operate horizontally or vertically . . . can be made integral with fly-wheels, pulleys, brake drums, etc.



They safeguard against unavoidable misalignment. Write for data book.

AJAX
FLEXIBLE
COUPLING CO. INC.
WESTFIELD, N. Y.



IN THIS
SPOT
...our
answer
is the
RAYTHEON
CAPACITOR MOTOR

Not by chance do so many engineering experts turn to the Raytheon Capacitor Motor for applications such as fans, blowers and torque motors!

Wherever extremely high efficiency must be packed into the most limited spaces—there you'll find this beautifully engineered little motor. A veritable jack-of-all-trades and master of them all, the Raytheon Capacitor Motor is supplied with special mountings—as well as with single and double shaft extensions. Write or wire for all the facts!

RAYTHEON MOTOR MODEL 340

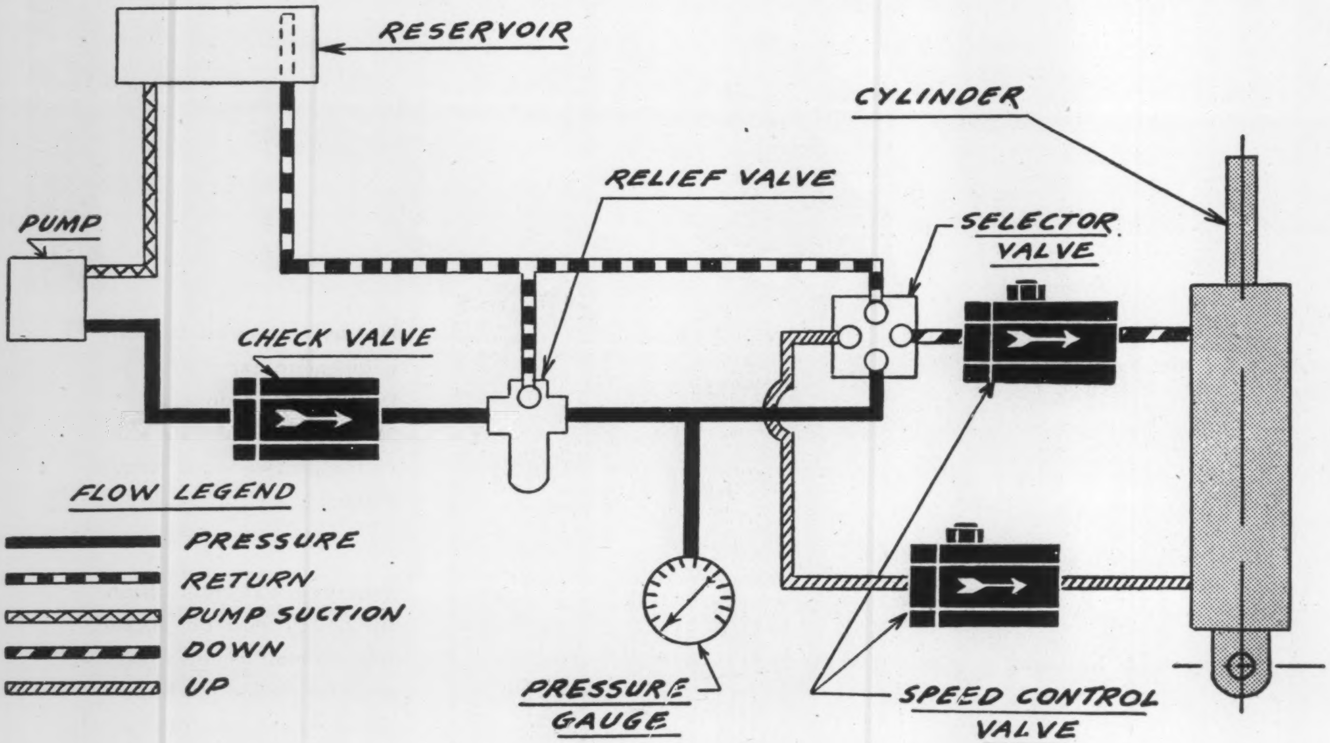
The CAPACITOR. Comes in 1/50 to 1/25 H. P. ratings. 3½" outside diameter. Speeds—1,700 and 3,400 RPM.

RUSSELL ELECTRIC COMPANY

340 West Huron Street • Chicago, Illinois

ELECTROL'S

CHECK AND SPEED CONTROL VALVES


RESERVOIR
CYLINDER
RELIEF VALVE
PUMP
SELECTOR VALVE
CHECK VALVE
FLOW LEGEND
PRESSURE
RETURN
PUMP SUCTION
DOWN
UP
PRESSURE GAUGE
SPEED CONTROL VALVE

FOR ALL HYDRAULIC SYSTEMS

The CHECK VALVE in this typical system allows full flow — with a minimum pressure drop — to enter the system when the pump is functioning. The CHECK VALVE provides positive sealing against return flow, thus locking the system pressure when the pump is not functioning.

Adjustment of the metering screw on the SPEED CONTROL VALVE sets the speed of the cylinder stroke at the desired rate. In this system the use of TWO SPEED CONTROL VALVES permits the control of the speed of both the instroke and outstroke of the cylinder.

CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES • CHECK VALVES • RELIEF VALVES • HAND PUMPS • POWERPAKS LANDING GEAR OLEOS • SOLENOID VALVES ON-OFF VALVES • SERVO CYLINDERS TRANSFER VALVES • CUT-OUT VALVES SPEED CONTROL VALVES

ELECTROL INCORPORATED

FOR BETTER HYDRAULIC DEVICES

KINGSTON, NEW YORK

GET A BEAD ON . . .

PEAK PERFORMANCE

Federal
MACHINE & WELDER CO.
WARREN, OHIO, U.S.A.

Photo Courtesy of
The FEDERAL
MACHINE & WELDER CO.
WARREN, OHIO, U. S. A.

With

GREER HYDRAULIC ACCUMULATORS

The Flash Welder shown here is equipped with six Greer Accumulators. This giant machine has a maximum upset pressure of 190,000 lbs. and is used for welding 6-in. diameter heavy wall tubing.

Four accumulators provide the oil for the upset pressure independent of the motor and pump. One accumulator maintains pressure in the pilot system during large demands of oil volume. The sixth accumulator maintains pressure on the clamps, thus assuring positive action of the clamps without relaxation during the welding process.

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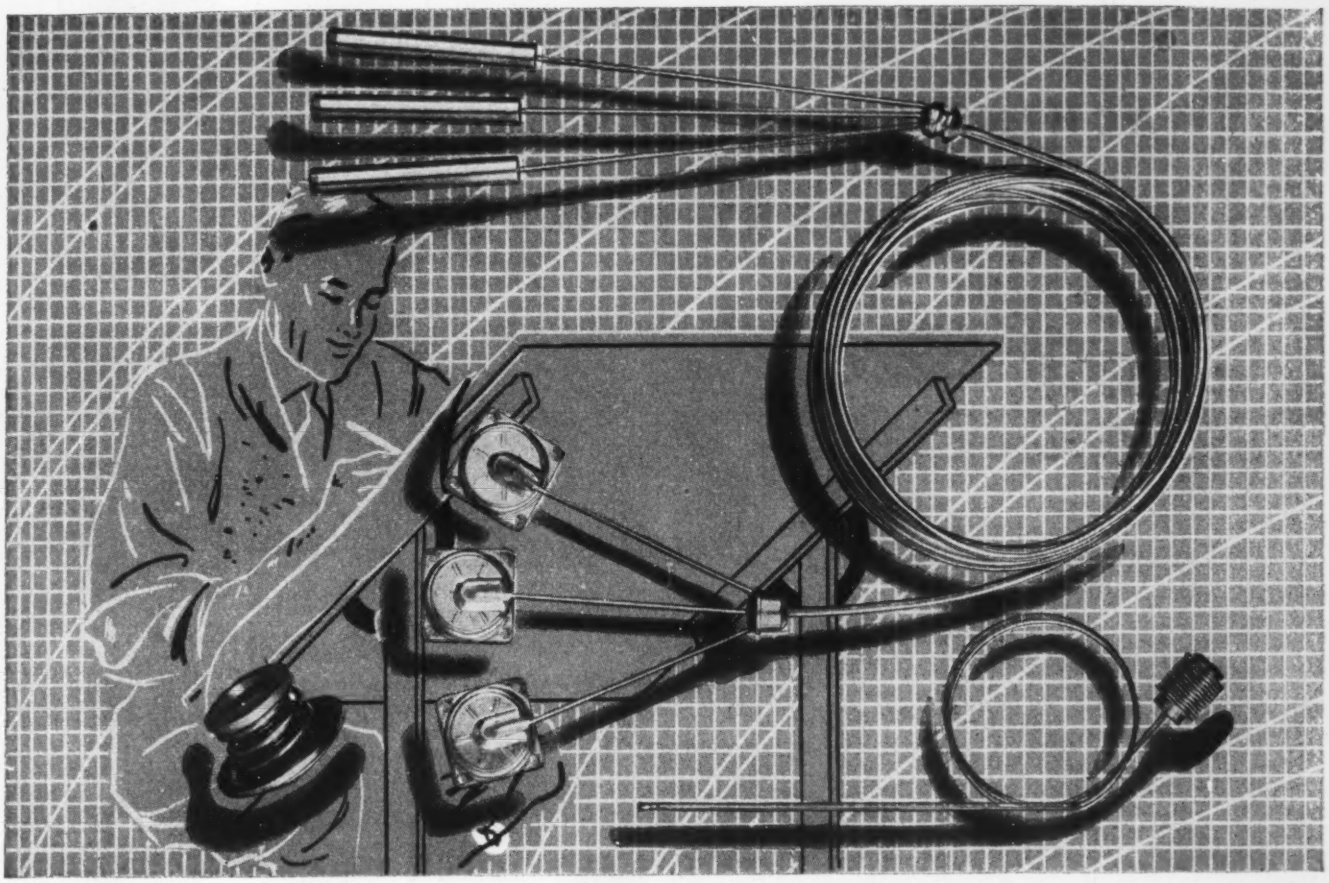

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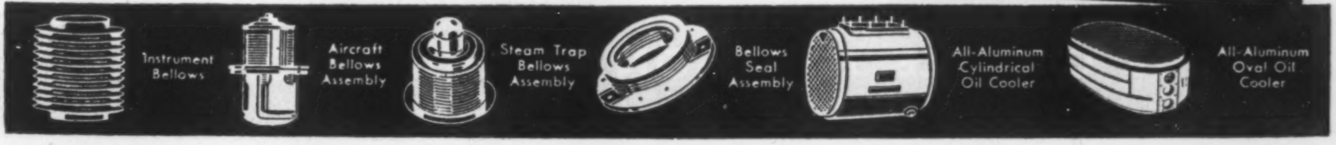
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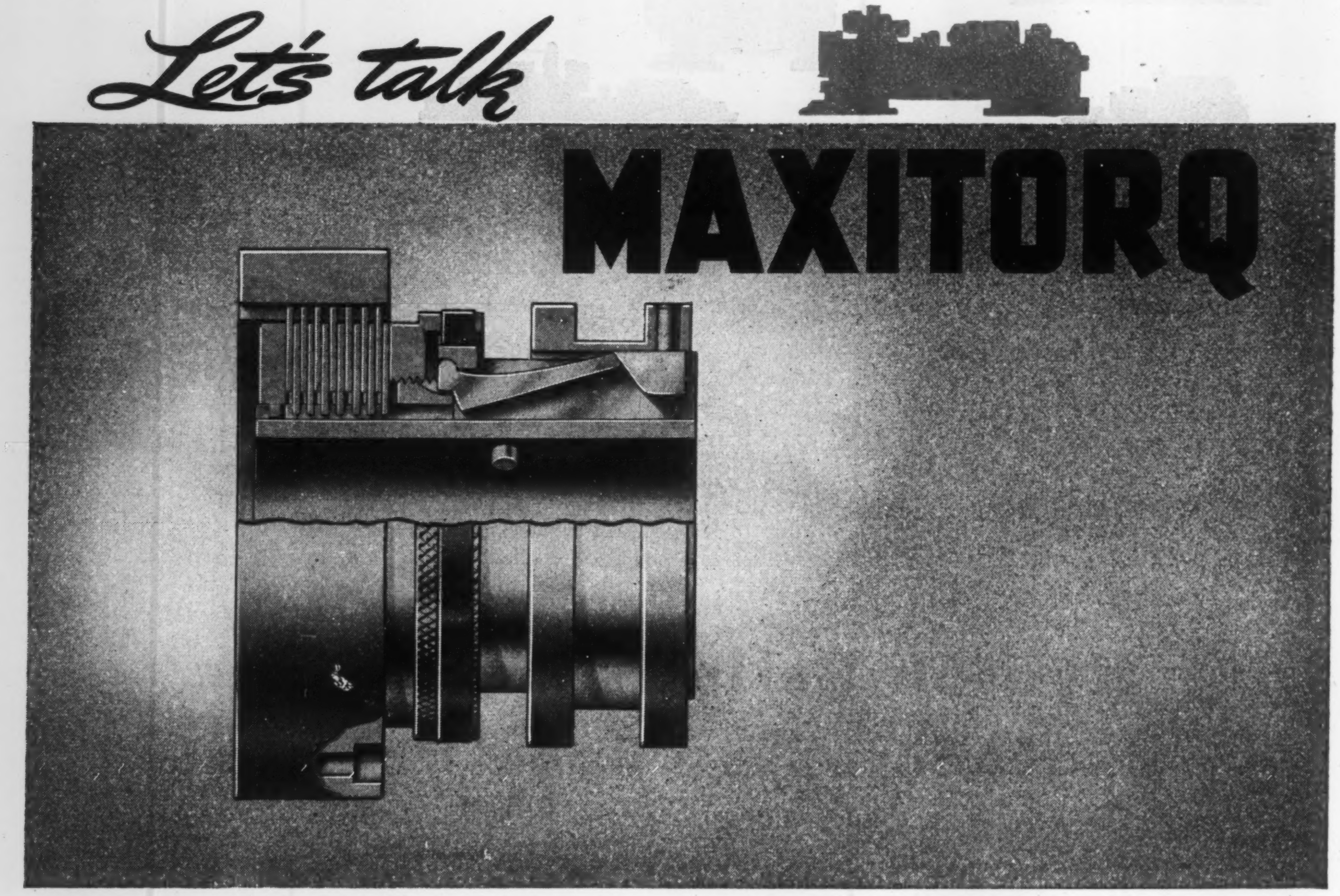

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by Airco flame hardening

Part: Rack Teeth
Material: SAE-4340
Hardness Obtained: 62 Rockwell "C" 86 Scl.
Depth of Case: 1/16 inch
Set-up Time: 1 hour
Cycle Time: 1 hour
Distortion: Not measurable

Performed on Gleason Flame-Hardening Machine with special positioning bracket. Teeth were skip and sight indexed to distribute heat evenly. Hardening done after finish grind.

Part: Bevel Ring Gear
Material: SAE-3140
Hardness Obtained: 52-57 Rockwell "C" 73-82 Scl.
Set-up and Checking Time: 3 hours
Cycle Time: 1¾ hours.
Number of Teeth Hardened: 135 (after finished grinding)
Distortion: 0.001" on face; .0002" in bore

Performed on Gleason Flame-Hardening Machine. Teeth were skip indexed, to distribute heat evenly.

Set-up and cycle time—2 hours for rack teeth . . . only 4¾ hours for ring gear

Airco Flame Hardening is fast . . . flexible . . . economical. It can be applied to single parts or to units in mass production, either in the shop or on the field . . . on flat or circular surfaces. The apparatus is simple in construction and operation . . . portable, it may be used in conjunction with lathe or other machine tools — or may be applied with *standard* Airco oxyacetylene equipment.

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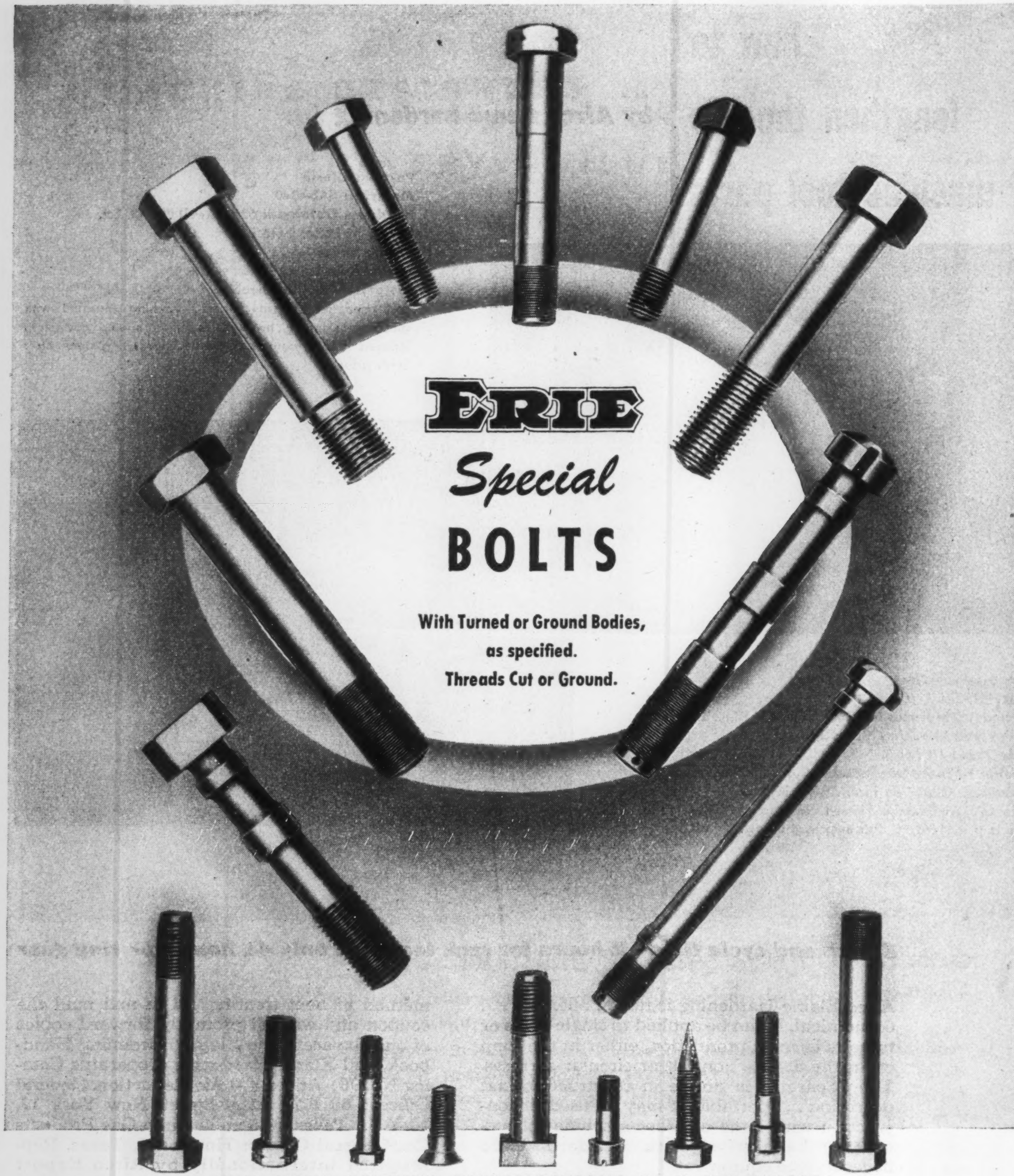

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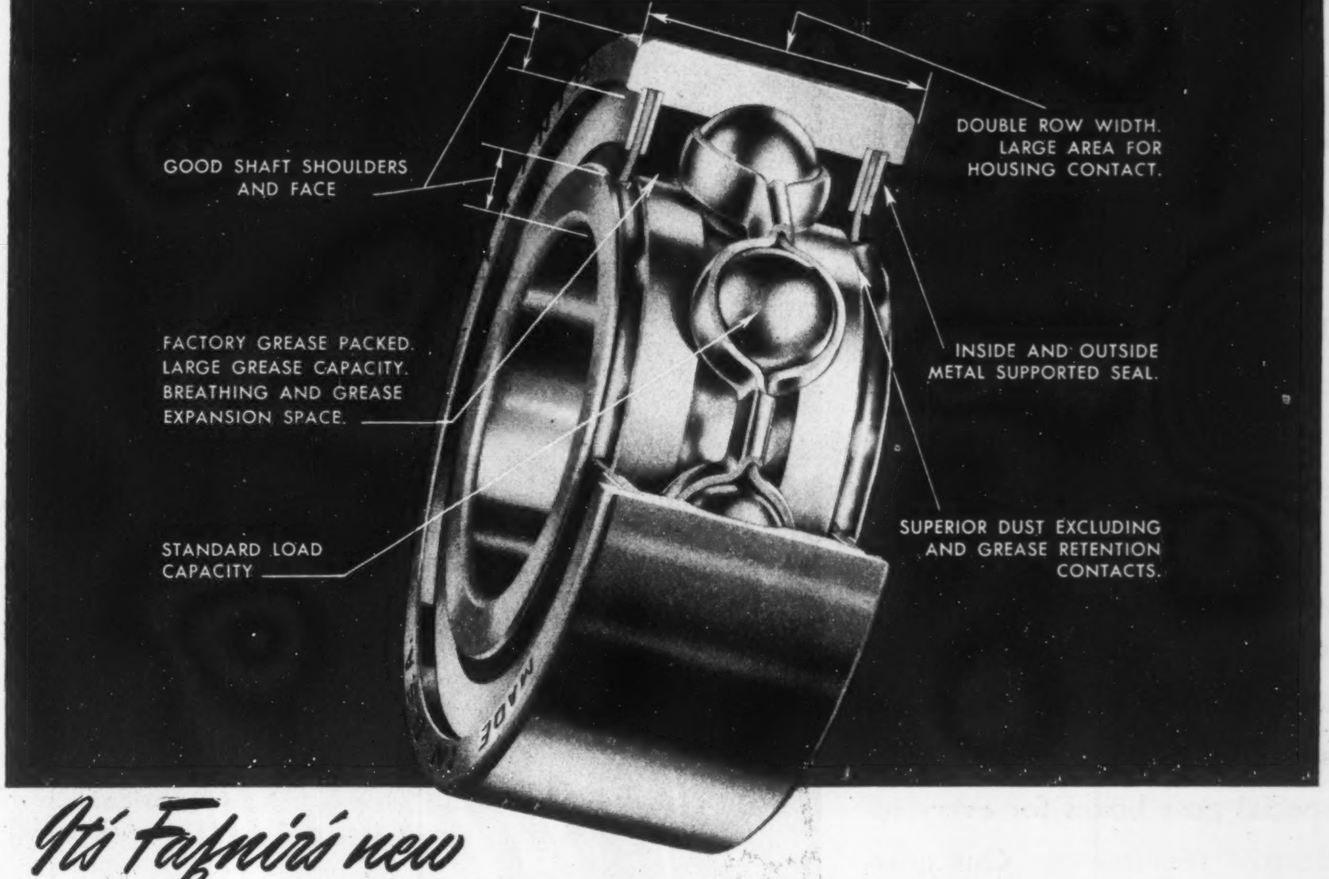
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If you can simplify complicated assemblies . . . eliminate parts . . . then you can cut out machining operations. Costs of both manufacture and maintenance come down. That's why manufacturers have said that Fafnir did a lot of things at one time when they developed the Wide Type Plya-Seal Ball Bearing. It has its own grease chamber and breather provision. Contaminants can't get in and grease can't get out.

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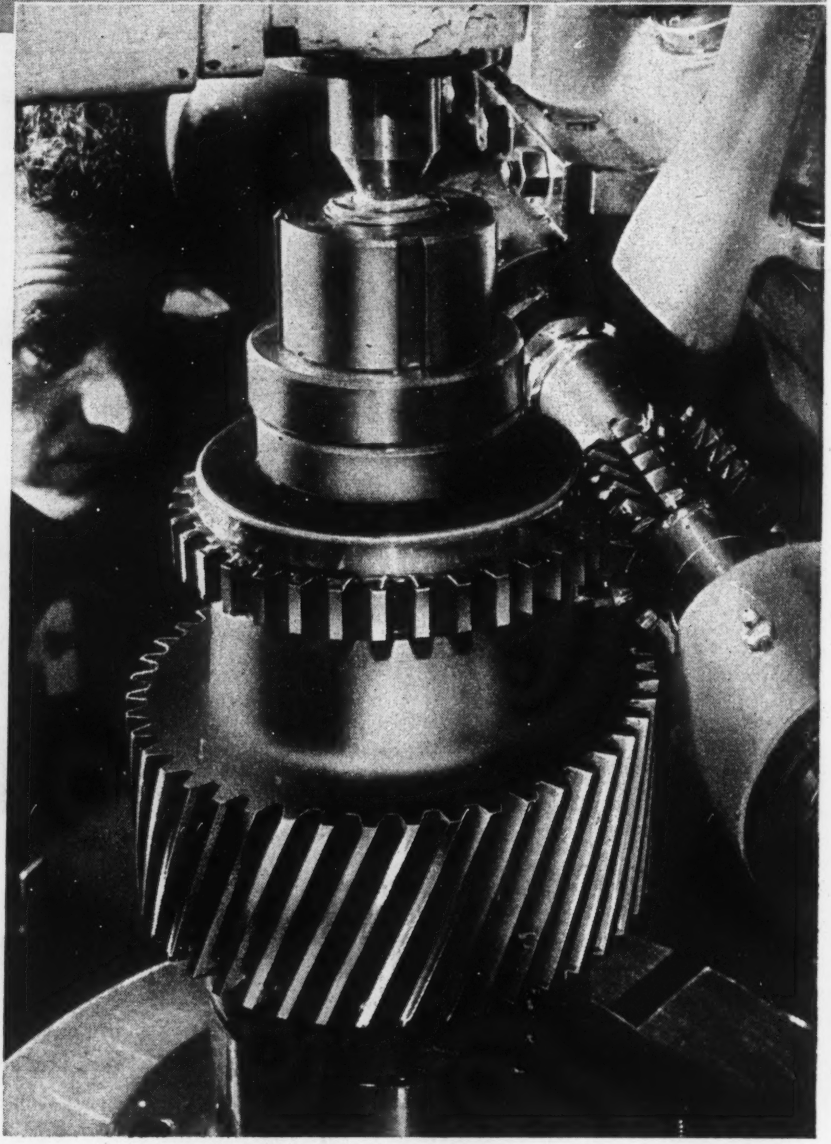

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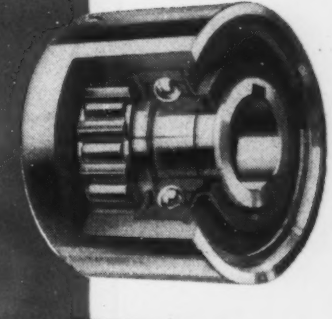
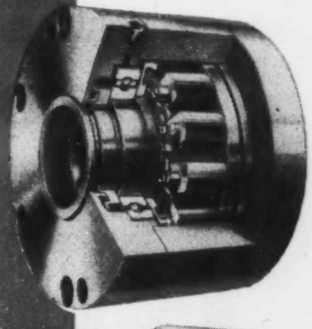


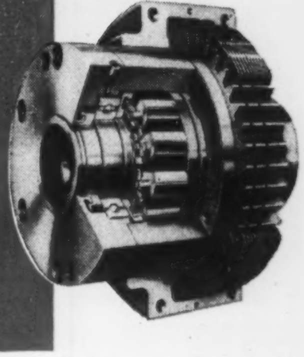
Indexing and Backstop CLUTCH

Instant and positive action of spring-actuated multiple cams makes this an ideal clutch for accurate indexing and backstop control on ratchet feed mechanisms.



Over-running and Indexing CLUTCH

For high speed free-wheeling, heavy duty indexing and backstop applications such as dual drives, blowers, pumps, mine car spotters, dry-cleaning and laundry equipment. Full load distribution is achieved through a large number of independent spring-actuated and gear-positioned cams.



Over-running CLUTCH COUPLING

A silent chain flexible coupling integral with the above free-wheeling clutch offers a cut-off type mechanism. This combination permits endwise drive applications.

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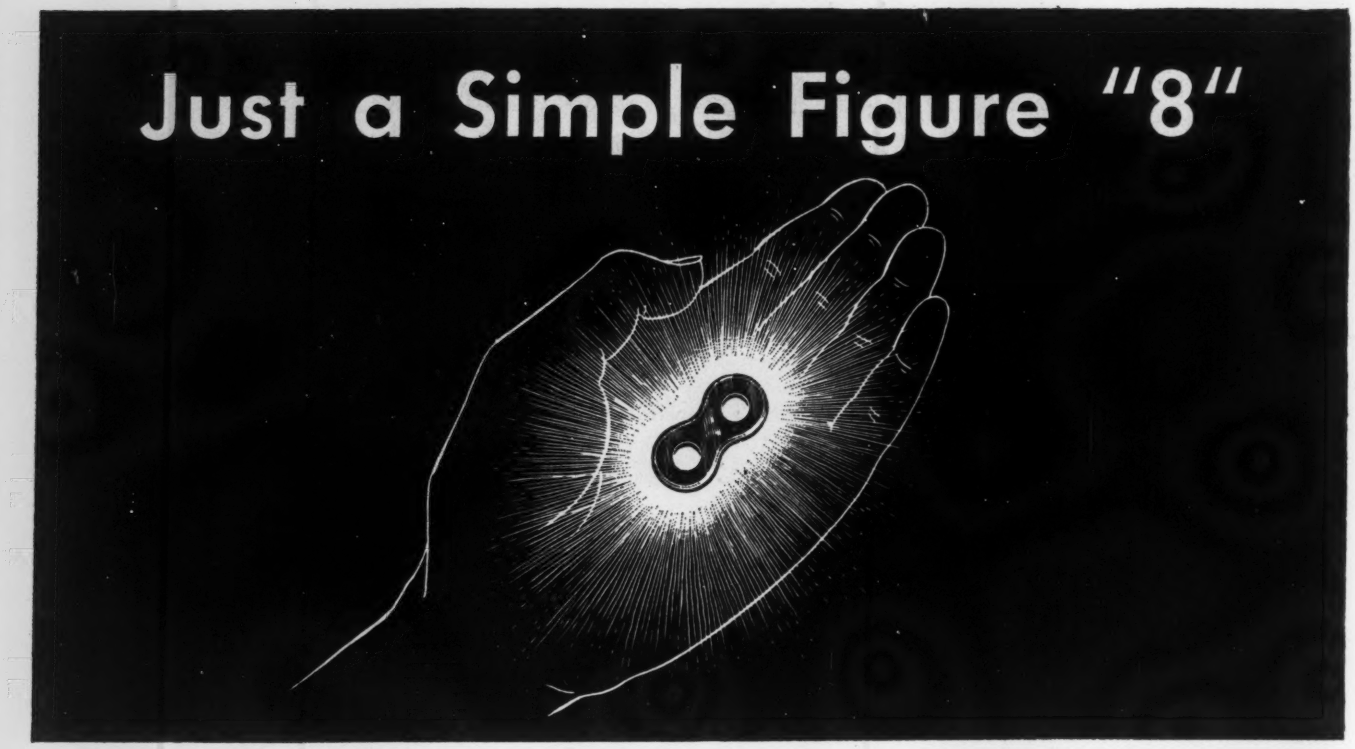
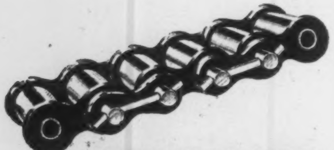




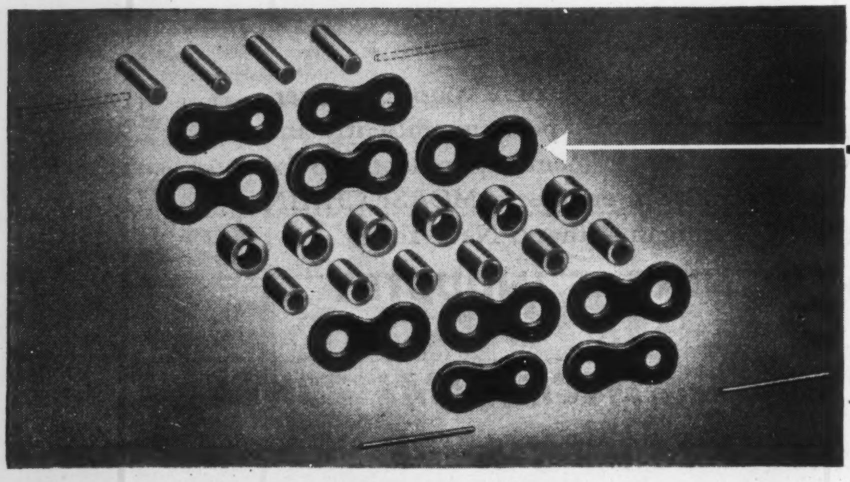
This short length of UNION roller chain is made up of the 28 separate parts shown below

UNION CHAINS

It's simple enough, true—but for all its simplicity its fabrication requires 12 distinct and precise operations. For this is a sidebar of a pitch of UNION roller chain. If you will look at the "exploded" drawing at the bottom of this page you will see that there are 10 of these sidebars (6 inner and 4 outer) in the short length of UNION roller chain shown at the left. You will also see that there are 28 separate parts in this same length of chain. But what you don't see is that it requires 290 operations to make these 28 parts. Nor can you see that every step from receipt of material to finished product is carefully supervised by an inspection department responsible to the engineering division.

Here at UNION CHAIN we make nothing but sprocket chains, sprockets and attachments. All our skill and effort are concentrated on the precision manufacturing of high quality chains of various types for the transmission of power and the handling of materials. We are not yet able to meet the overwhelming demand for UNION chain, but we assure our customers and friends that we are making every effort to do so, consistent always with the character of our product and the complicated processes of its manufacture.

The Union Chain and Manufacturing Company • Sandusky, Ohio



THESE 12 OPERATIONS TO MAKE THIS STEEL SIDEBAR

1. Straighten stock material
2. Pierce pitch holes
3. Blank link contour
4. Coin link edges
5. Stamp name and number
6. Straighten link
7. Broach pitch holes
8. De-grease
9. Heat treat and quench
10. Clean and polish
11. Temper
12. Color

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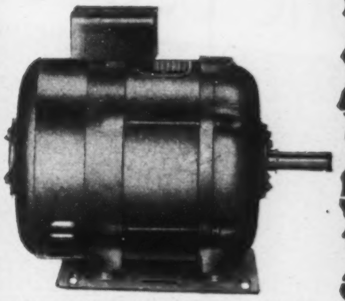
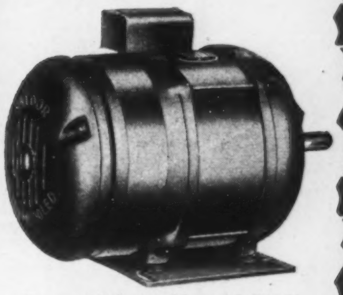
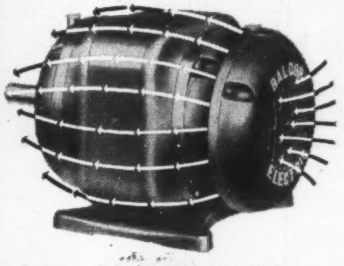
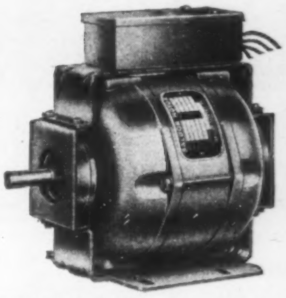

Open, drip-proof construction; 1/6 to 1/3 h.p., 1 phase, 3 phase and direct current.

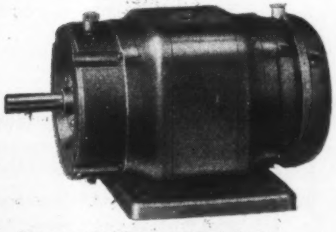

Streamcooled, round frame, 1/3 to ¾ h.p., 1 phase, 3 phase and direct current.

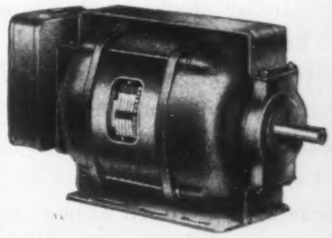

Streamcooled, polyphase, 1 to 20 h.p. (arrows indicate forced air cooling over entire exterior of motor frame).

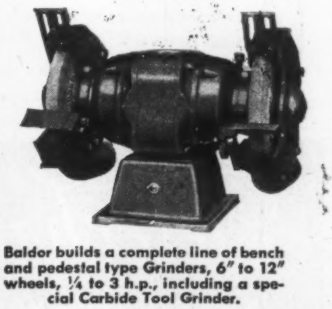
Streamcooled, single phase, ¾ to 7½ h.p.


Resilient-mounted, open, drip-proof, for belt drive; 1/10 to ¾ h.p., single phase.

Streamcooled, direct current, 1 to 5 h.p.


Streamcooled face mounted; 1 phase, 3 phase and direct current.


Resilient-mounted fan motor 1/30 to ½ h.p., 1 phase; ⅛ to ½ h.p., 3 phase.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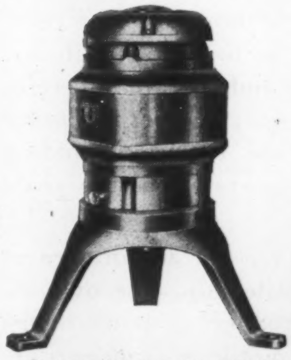
Streamcooled, face-mounted with tripod; for vertical mounting.

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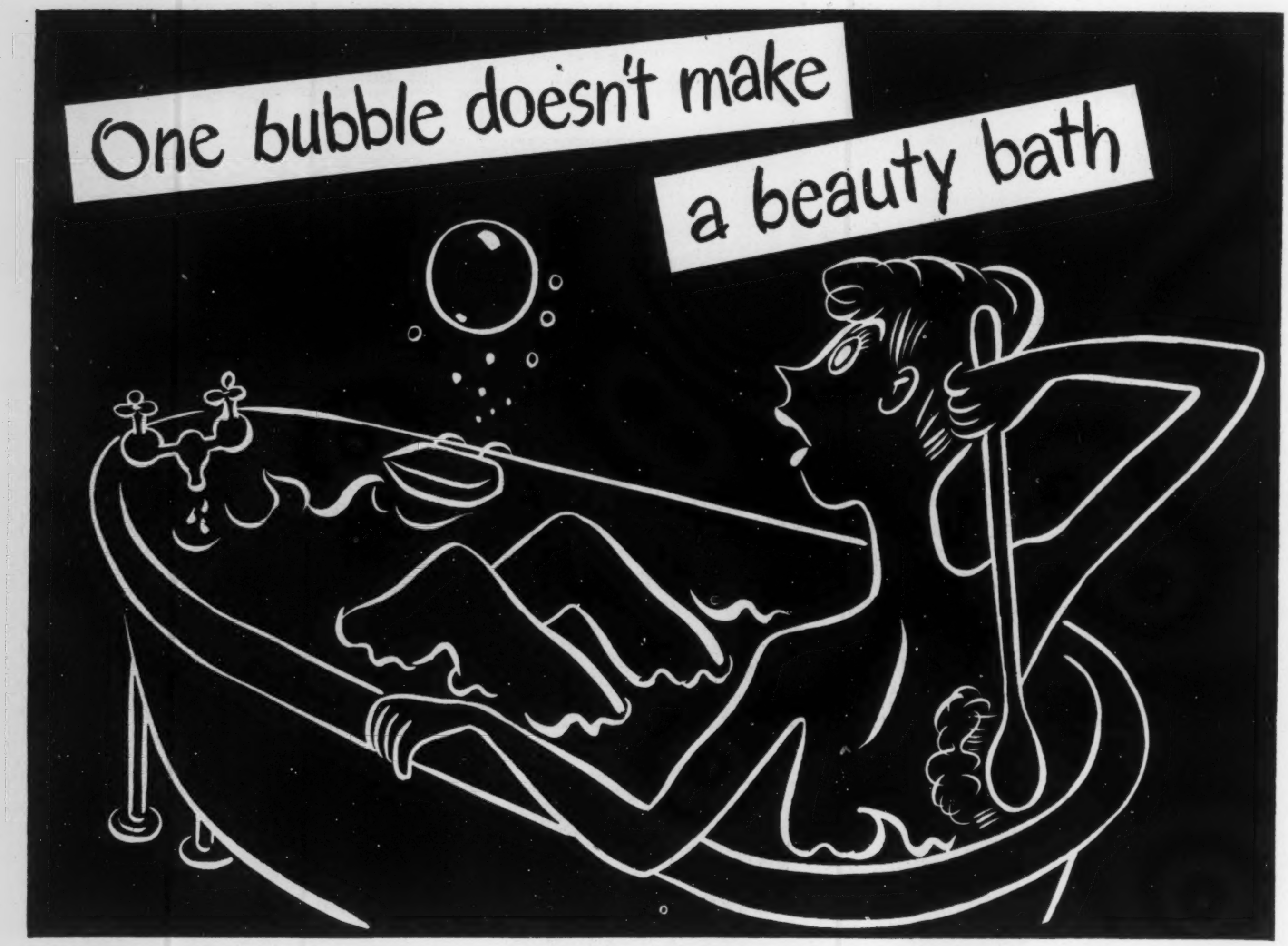
FOR MORE THAN A QUARTER OF A CENTURY



BUT a gal's lucky to get even one in some parts of the country. The water is so hard it's necessary to use water softeners. The operation of many softeners is timed with Telechron synchronous electric motors.

This application is typical of the unusual jobs being found every day for these versatile motors. They have been used successfully in clocks and timing devices for 25 years—and more. They have given dependable service in automatic timing, switching, recording and control equipment. Chances are a Telechron motor is the answer to your own needs.

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The first and favorite synchronous electric timing motor

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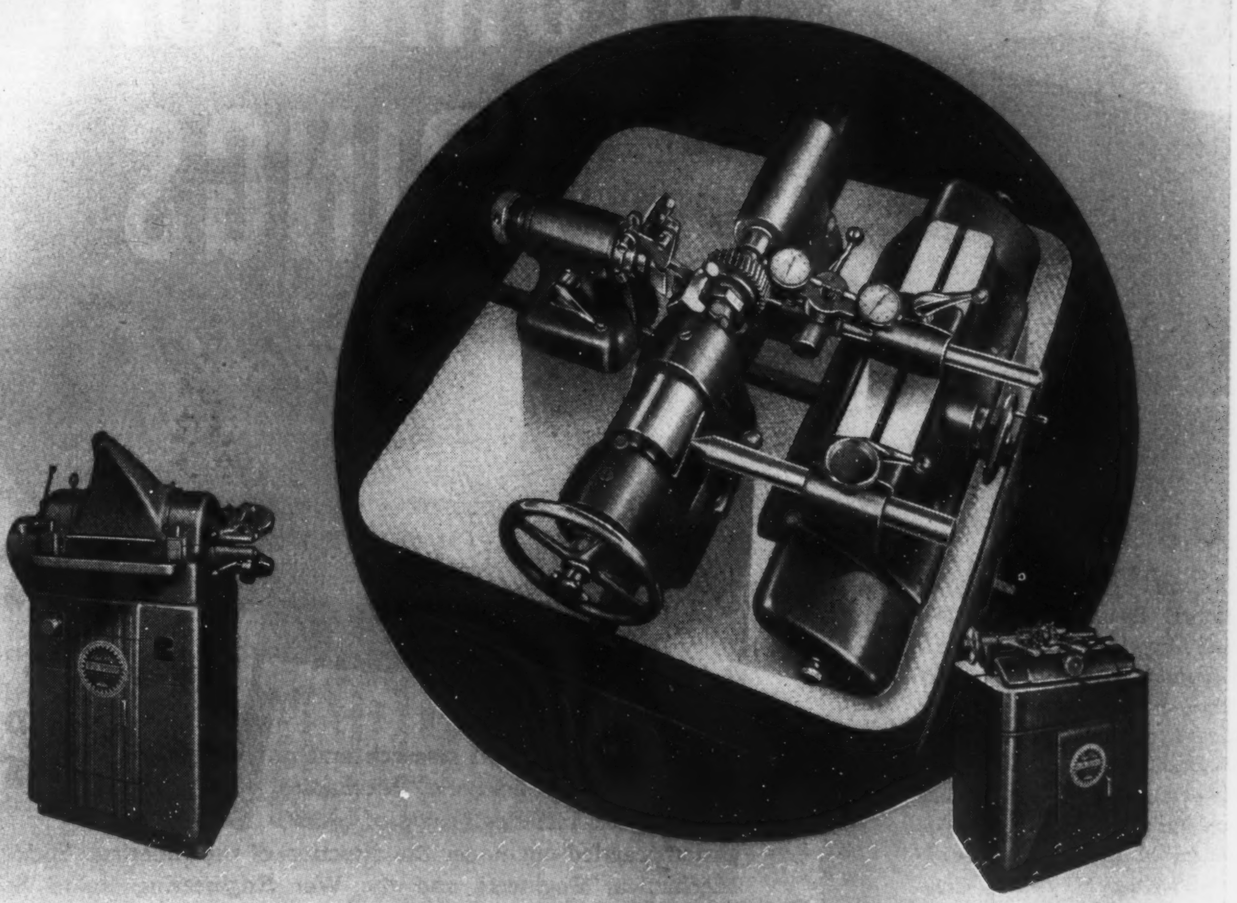

If you know how much of an error you have in index, helical angle, lead, parallelism, tooth size, eccentricity or interference, you can determine what must be done to correct it.

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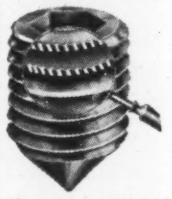
PAT'D and PATS. PEND.

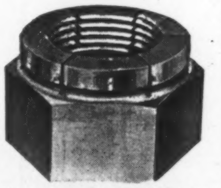
"UNBRAKO" SOCKET SET SCREW WITH KNURLED THREADS



Knurling the "Unbrako" Socket Set Screw, as shown, swages the threads and an excellent Self-Locker is the result — For use where the points such as: flat, dog, cone and oval do not lend themselves to knurling.

PAT'D AND PATS. PEND.

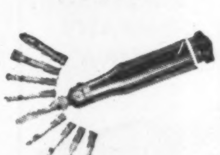
"FLEXLOC" SELF LOCKING NUTS



The All-Metal, One-Piece "Flexloc" is a Self-Locking Nut that won't budge, except when a wrench is used. Every thread—takes its share of the load and being a "Stop" nut it will stay locked in any position on a threaded member—"a real fastener", if ever there was one. Free samples.

PAT'D & PATS. PEND.

"HALLOWELL" KEY KIT



PATS. PEND.

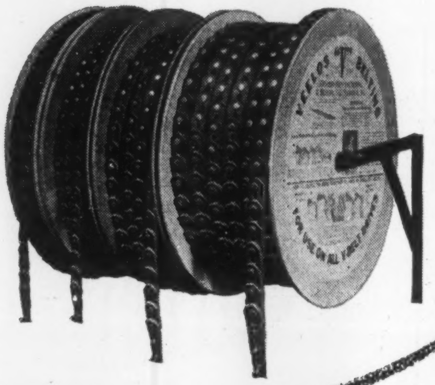
You can't tighten or loosen socket screws without a hex socket wrench, so why not get our No. 25 or No. 50 "Hallowell" Hollow Handle Key Kit which contains most all hex bits.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 102 · BRANCHES: BOSTON · CHICAGO · DETROIT · INDIANAPOLIS · ST. LOUIS · SAN FRANCISCO

WHEN YOU REACH FOR A SPARE
IS THE RIGHT SIZE Always THERE?

Here's all you need to be sure of Every Size you need



WHATEVER length V-belt you may require, it's always on hand when you use Veelos, the link V-belt on reels. From just four reels you can replace up to 316 standard sizes. Need less? Any length belt can be uncoupled from a single reel, quickly coupled endless on the drive.

. Veelos on reels banishes costly belt inventories. Stocking matched sets for each drive is eliminated. You *profitably* use every bit you buy. There is no belt waste. Time-consuming paper work is greatly reduced. Reels of Veelos hold 100 feet . . . save stockroom space. Veelos is available in all standard widths, fits all standard grooves.

Sales engineers are located in all principal cities; over 300 distributors throughout the country.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PENNSYLVANIA

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

New Veelos Catalog shows you how to get the *right* length V-belt right off the reel. You'll see it uncoupled, made endless, installed (pages 8 and 9). All 14 Veelos advantages are described in detail. Complete engineering data is provided. Also, a dozen pages—packed with photographs—show Veelos at work in a wide variety of industries. *Your free copy sent on request.*

Tested, Proved and Adopted by American Industry

KNOWN AS VEELINK OUTSIDE THE UNITED STATES

1 **1561**—Crude, manually-operated bellows were used in an attempt to pump fresh air into a mine, but with indifferent results, according to a journal published in Switzerland. And man's quest for comfort indoors was under way.

2 **1890**—This age-old method of keeping cool was still in use in many parts of the world. But in this era electric motors came into general use. Soon to come were new ways to make air work for man's comfort and well-being.

3 **1915**—The Howell Red Band Motor made its appearance. Seven years later the first movie theater was fully air conditioned. Other businesses followed. Air conditioning was on its way, thanks to the electric motor as a source of power.

Then, Air Conditioning arrived!

Shop
IN
COOL COMFORT

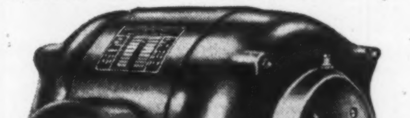
4 **Today** it's different! And better!

Air is universally used for comfort . . . for profit. It's the exceptional business that does not put air to work.

In the air conditioning and allied industries, you'll find Howell Motors driving fans, blowers, exhausters, air washers, compressors and conditioning equipment, as well as pumps, heating, drying and cooling apparatus. And you'll find every user has a good word for Howell!

Why? Because Howell Motors are industrial type motors designed for the toughest applications in industry. Consequently, they perform better on all jobs. Are you using them?

Here's another precision-built Howell Motor. Howell Motors are industrial type with copper or bronze rotors—specially insulated—statically and dynamically balanced. Be sure you specify Howells!



The Howell Protected Type Motors

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Manufacturers of Quality Industrial Type Motors Since 1915

LEADING DIE CASTING PRODUCERS

PREFER THE KUX

HIGH PRESSURE COLD CHAMBER MACHINE

for aluminum, brass and magnesium alloys

because it has been proven that the powerful Kux machines permit round-the-clock trouble free operation with *less down time—less maintenance.* Quality die castings of aluminum, brass or magnesium are quickly and easily made with these fully hydraulic, massive machines. Aluminum castings weighing up to 4 lbs. can be made under injection pressures ranging up to 10,000 lbs. PSI. Easily controlled by one operator, Kux machines are built low to facilitate hand ladling and designed to withstand the high injection and die locking pressures. Push-button operation and automatic timing plus double safety mechanisms are built into all models. *Write for illustrated catalog containing complete information.*

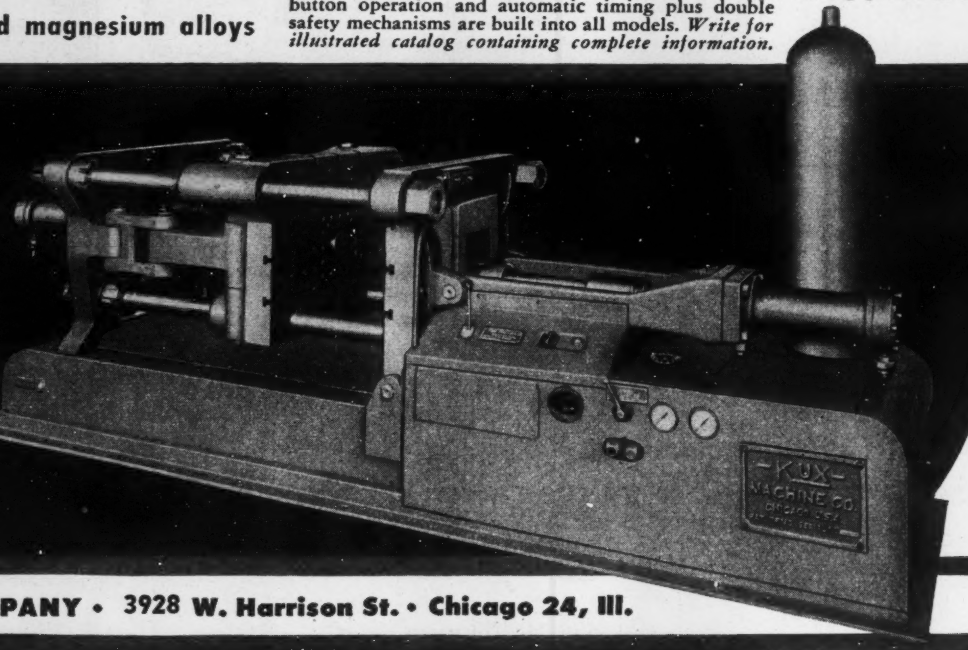
KUX

MODEL HP-25

Die space between bars 18" x 31"

Die Separates 12"

Die Mounting Plates 30" x 33"

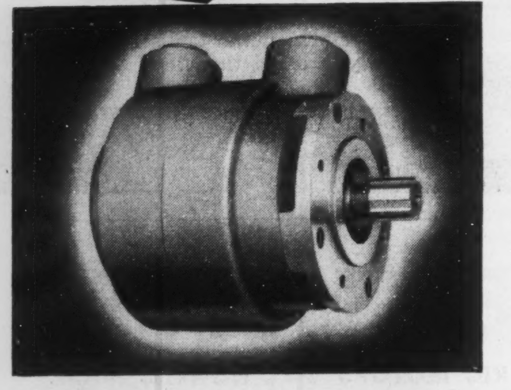


KUX MACHINE COMPANY • 3928 W. Harrison St. • Chicago 24, Ill.

Looking for an Outstanding *Small Pump?*

Here It Is!

THE NEW DUDCO 2000 PSI HYDRAULIC VANE-TYPE PUMP



Volumetric efficiency of 97%. Weight 55 lbs. Diameter 6-3/8". Capacity 2 to 18 gals. per minute at 1200 OR 1800 rpm. Rugged construction, compact design, simple maintenance. All these facts add up to make the new Dudco Small Series Pump adaptable to an unusually large number of applications. A revolutionary Dudco patented feature balances the radial vanes hydraulically and eliminates bearing loads. Vanes are kept tight against the ring regardless of speed or pressure. Dudco Small Series Pumps can be used in combination with larger pumps for high volume low pressure and low volume high pressure requirements. Larger Dudco Pumps available in two series: P-32 for 2000 psi up to 32 gpm and P-80 for 1500 to 750 psi up to 80 gpm.

DUDCO SMALL SERIES PUMP
(2000 PSI)

Model Number	Del. GPM @ 1800 RPM*	Max. Pressure, PSI	Peak Pressure, PSI	HP Input @ Max. Pres.
P-2	2	2750	3000	3.8
P-3.5	3.5	2750	3000	6.6
P-5	5	2500	2750	8.6
P-8	8	2250	2500	12.4
P-15	15	2000	2250	20.6
P-18	18	1750	2000	21.6

**Pump for volume shown also available for 1200 RPM operation*

DUDCO HYDRAULIC VANE-TYPE MOTORS—in two sizes with torques of 6 lbs.-in. to 250 lbs.-in. per 100 psi, using pressures up to 2000 psi. In many cases transmissions can be eliminated due to Dudco's slow speeds (less than 10 rpm with high torques)—a substantial saving in equipment cost.

Write for Details

Descriptive folder and technical data sheets sent on request. Inquiries about specific problems welcome. Our engineering dept. will gladly advise you.

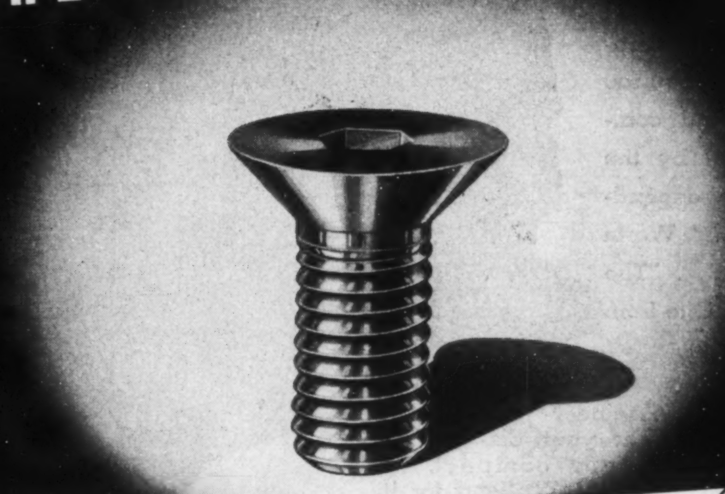
DUDCO PRODUCTS COMPANY

Formerly DETROIT UNIVERSAL DUPLICATOR CO.

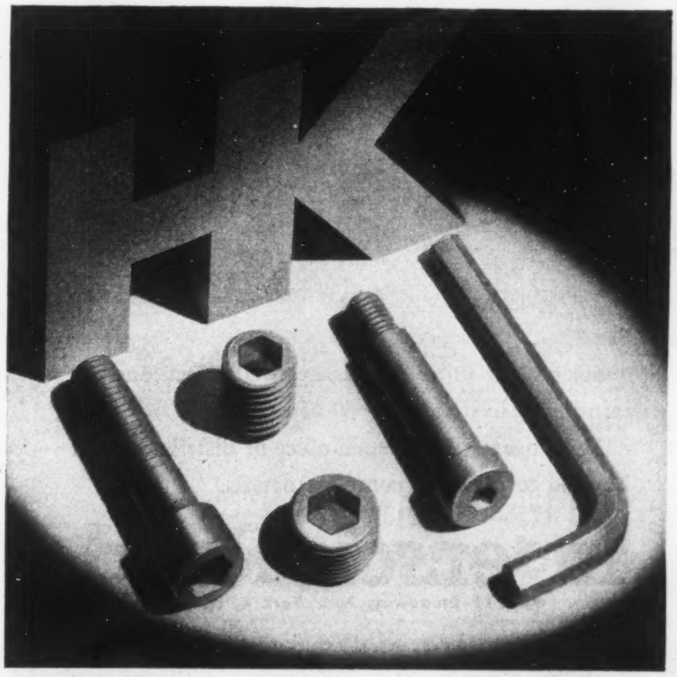
18100 RYAN ROAD • DETROIT 12, MICHIGAN

Dudco Vane-Type Pumps will operate at 1800 rpm in all volumes from 2 to 80 gpm. This is important in the resultant savings on cost of electric motors.

PRESENTING A NEW MEMBER OF THE **HOLO-KROME** FAMILY...



HOLO-KROME
FLAT HEAD
SOCKET CAP SCREW



COMPLETELY COLD FORGED

Not Drilled - Broached - Machined

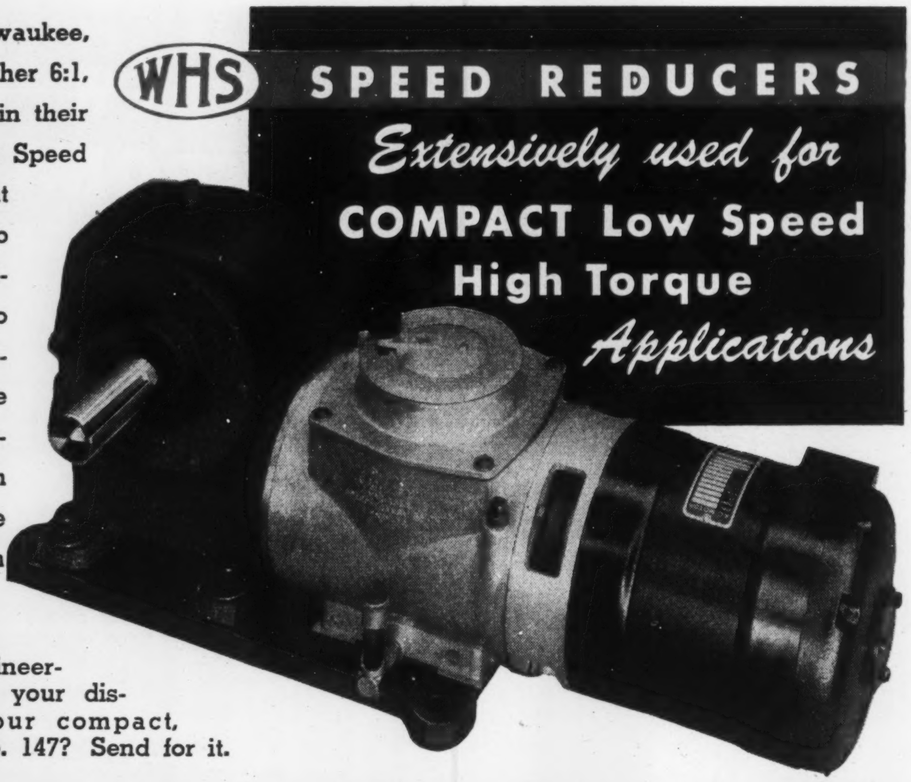
Holo-Krome Fibro Forged Flat Head Socket Cap Screws are made by an exclusive Holo-Krome patented method whereby the Head and Body in fact, all portions of the screw (threads excepted, Standard Class 3 fit) are Completely Cold Forged. Fibro Forged Screws inherently have the completely continuous fibrous structure that results in increased strength. Specify "Holo-Krome" for Guaranteed Unfailing Performance.

HOLO-KROME

fibro forged TRADE MARK

INTERNAL **SOCKET SCREWS** WRENCHING

THE HOLO-KROME SCREW CORP., HARTFORD 10, CONN., U. S. A.

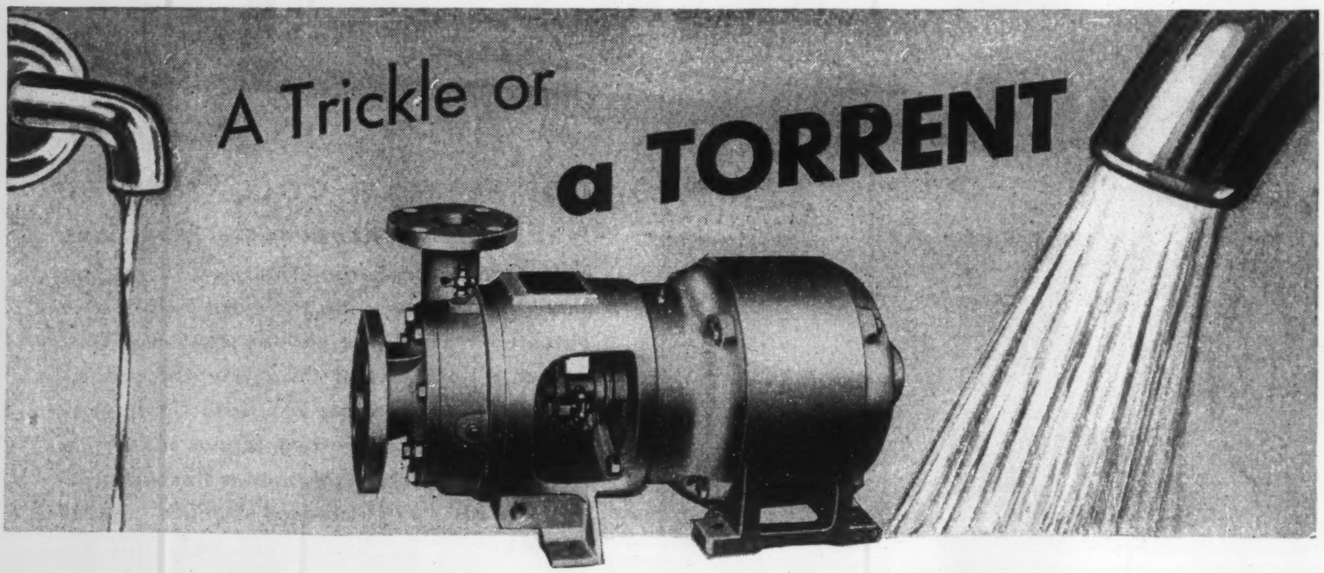


Graham Transmissions, Inc., Milwaukee, Wis., offer worm reductions of either 6:1, 9:1, 12:1, 18:1, 36:1, 47:1 or 60:1, in their new Model 40 Graham Variable Speed Transmission. In all units, output speeds are had from maximum to zero, plus reverse if wanted. Vertical output shafts are available, too . . . all this versatility and compactness materially aided by the 46-year proved design and dependability of WHS Series "B" Worm Gear Speed Reducers . . . "The Most Complete Line Available from Any One Source".

MEMBER OF AGMA

Our experienced Engineering Department is at your disposal. Have you our compact, pocket-size Catalog No. 147? Send for it.

WINFIELD H. SMITH CORPORATION
16 ELTON STREET . . . SPRINGVILLE . . . ERIE COUNTY . . . NEW YORK



No matter what the pumping requirement, there is an Ingersoll-Rand pump to suit the conditions.

In countless applications you will find that the I-R Motorpump is ideal for the job. These self-contained units have those "extra" built-in qualities that assure pumping satisfaction.

Sizes ¼ to 40 hp deliver up to 1800 gallons per minute against heads to 600 feet.

Your nearest I-R branch office or distributor will be glad to give you complete details.

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11 Broadway, New York 4, N. Y. 9-856

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These Two Names

ON ANTI-FRICTION BEARINGS ARE YOUR ASSURANCE OF *QUALITY, DEPENDABILITY* AND *PERFORMANCE* WHICH ENABLE YOU TO CUT COSTS AND INCREASE PRODUCTION

Dodge-Timken Double Interlock Pillow Block. Dodge mounts, seals and houses the bearing assembly, delivers the pillow block fully assembled ready to lock on the shaft and run at full speed and full load. This is one of the famous Dodge 30,000 hour line, covering a wide range of industrial bearing requirements, and promptly available from Dodge distributors' stocks.

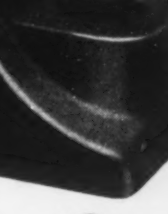
DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

your local Dodge distributor, for news of latest developments in power transmission equipment. Look for his name in your classified phone book under "Power Transmission Equipment."



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PORTRAIT OF AN

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FOREMAN

who says that even
the newcomers can
mate units more quickly
when they assemble
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MACHINE
PRODUCTS
made
FASTER
and
BETTER
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by

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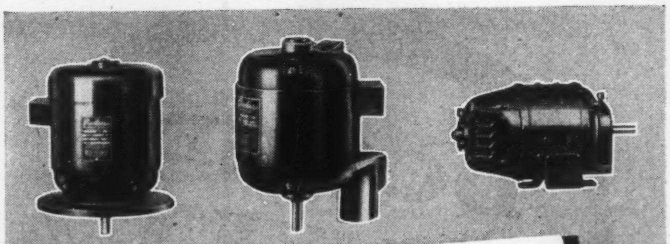

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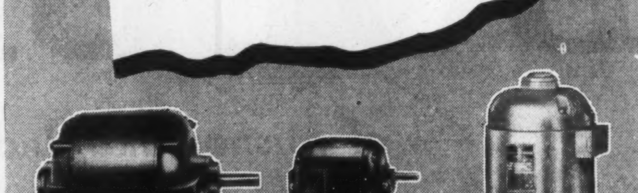
MOTORS
ARE
"PEERLESS REGISTERED"
T. M. REG. U. S. PAT. OFF.

You need not pick Peerless motors "off a shelf" for original equipment installations. More than 90% of all Peerless motors produced are manufactured to meet the specific operating requirements of the equipment with which they are to be used.

This is one reason why Peerless motors are registered—before shipment. The registration record is assurance to both you and your customer that the Peerless motor has been properly designed for the equipment so as to give best possible performance and long, satisfactory service.

THE PEERLESS ELECTRIC COMPANY
Manufacturers of Quality Motors for More than 50 Years
Single Phase—Polyphase—Direct Current
WARREN, OHIO



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at work!
. . . for a waffle iron . . .
or an asphalt hose . . .
. . . or dust collectors

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REX-TUBE

Flexible metal hose!

Three photos can show only the beginning of uses for Rex-Tube Flexible Metal Hose. And there's a good reason for this wide range utility . . . Standard Rex-Tube is made in *24 different types* of galvanized and stainless steel, brass, aluminum, and other alloys . . . in sizes from 5/32" to 12" inside diameters!

Each Rex-Tube type has been developed to handle certain applications best. CMH leadership in the science of FLEXONICS* provides the knowledge necessary to make Rex-Tube dependable and long-lasting in service, where temperature, pressure, vibration or corrosion conditions are unusually severe.

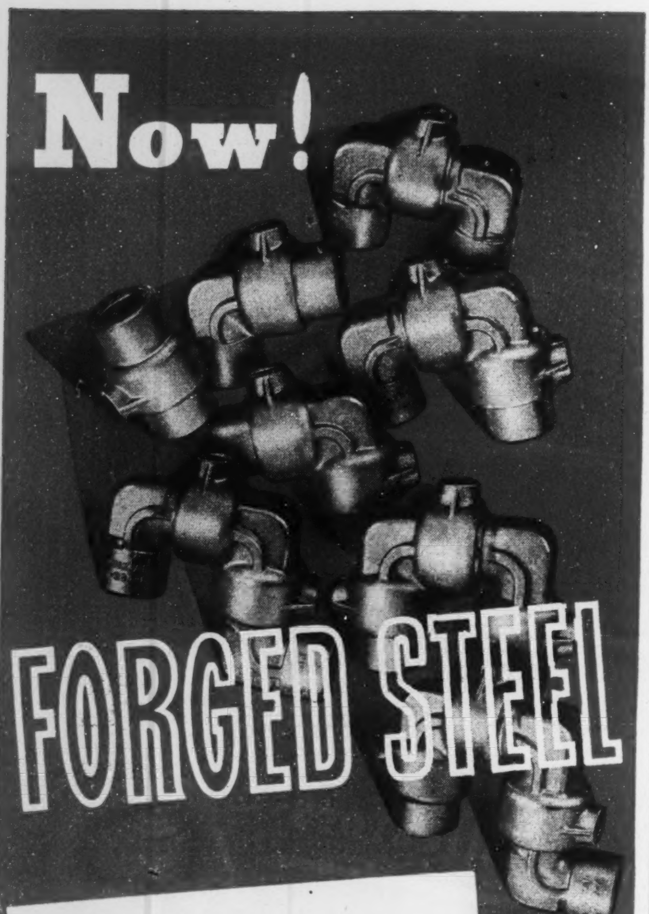
Write today for CMH Catalog G-47 . . . It gives full details on Rex-Tube — and on other CMH quality products.

*the science of FLEXONICS . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

"FLEXON" *identifies CMH products, which have served industry for more than 45 years.*

CMH **CHICAGO METAL HOSE CORPORATION**

Maywood, Illinois • Plants: Maywood and Elgin, Illinois



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CHIKSAN

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CHIKSAN has adopted **forged steel** for all Styles and Sizes to and including 2"...in the following pressure ratings: 1,000 psi, 3,000 psi, 12,000 psi and High Temperature (700 psi, 500° F.). This important development now brings even higher quality to CHIKSAN users everywhere. It is tangible evidence of CHIKSAN's policy for continuous development in the design and manufacture of *Ball-Bearing* Swivel Joints for all purposes.

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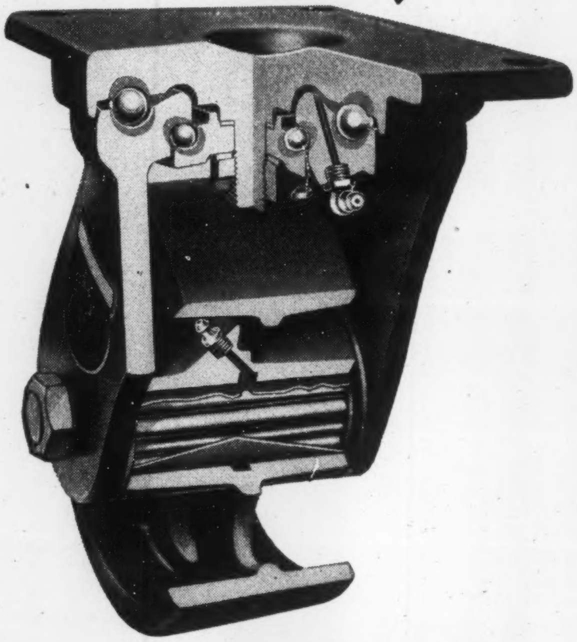
RAPIDS-STANDARD CASTERS

STEEL-FORGED FOR *Strength*



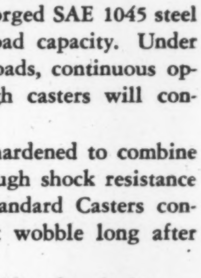
FLAME-HARDENED FOR LONG-*Wear*

Rapids-Standard Casters are made of drop-forged SAE 1045 steel for maximum strength and greatest overload capacity. Under the toughest running conditions — shock loads, continuous operation, constant overloading — these tough casters will continue to roll easily and smoothly.

The swivel bearing ball races are flame hardened to combine extreme hardness at contact points with tough shock resistance in the caster body. As a result, Rapids-Standard Casters continue to swivel smoothly and run without wobble long after other casters have been replaced.

Rapids-Standard casters come in both rigid and swivel types with a choice of bearing depending upon the service for which they are intended. Wheel types include Nicro-Steel, Forged Steel, Resinoid and Rubber. Rapids-Standard offers a bearing and wheel combination to exactly suit your application in a capacity for any type of industrial application.

The new Rapids-Standard Caster Catalog is now ready. It contains complete specifications on sizes, types, capacities together with suggestions for more efficient caster use. Write for your copy today.



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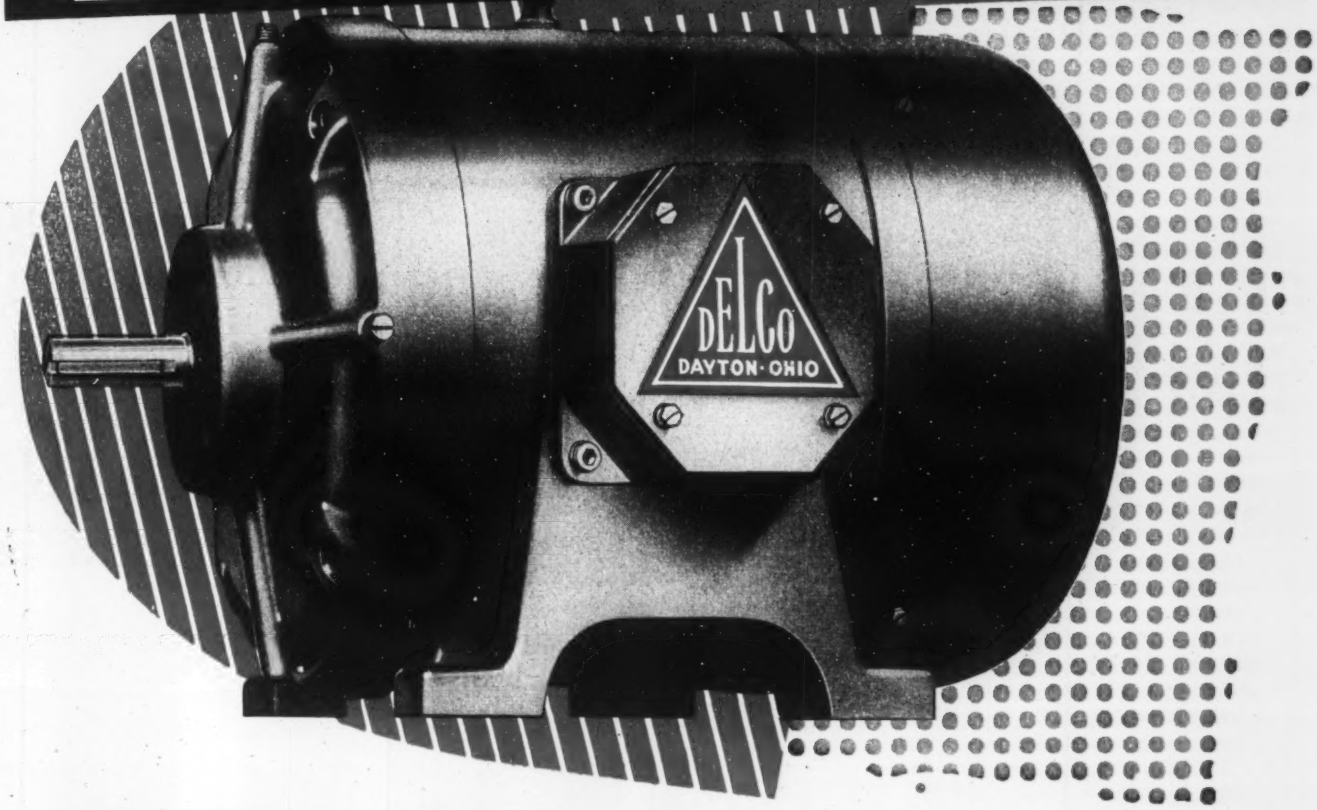
Manufacturers of
STEEL FORGED CASTERS • TRUCKS • CONVEYORS • POWER BOOSTERS

The Rapids-Standard Co., Inc.

Sales Div.—330 Peoples Nat'l Bank Bldg., Grand Rapids 2, Mich.

protected power for better production



The New Delco Motor

It's totally enclosed—*completely* protected against airborne dust, sand, scale and other injurious particles. That's the *outside* reason why the new Delco motor sends production up and maintenance costs down.

Inside, there are improved materials and new design practices to make the new Delco motor simpler and more rugged. Coils are individually taped. Windings are thoroughly insulated. The motor is more easily attached to tools, runs cooler and requires less maintenance.

If you have a problem of keeping machine tools operating under adverse conditions, the new Delco motor is your answer. Write for complete data.

HIGHLIGHT FEATURES OF THE NEW DELCO MOTOR

Totally enclosed; fan-cooled.

Individually taped coils.

Thoroughly insulated windings.

Unit-cast, ball-bearing rotor, dynamically balanced; parts interchangeable end to end.

Double-shell frame with new simplified cooling system

Extra-large watertight conduit box; usable in four 90-degree positions.

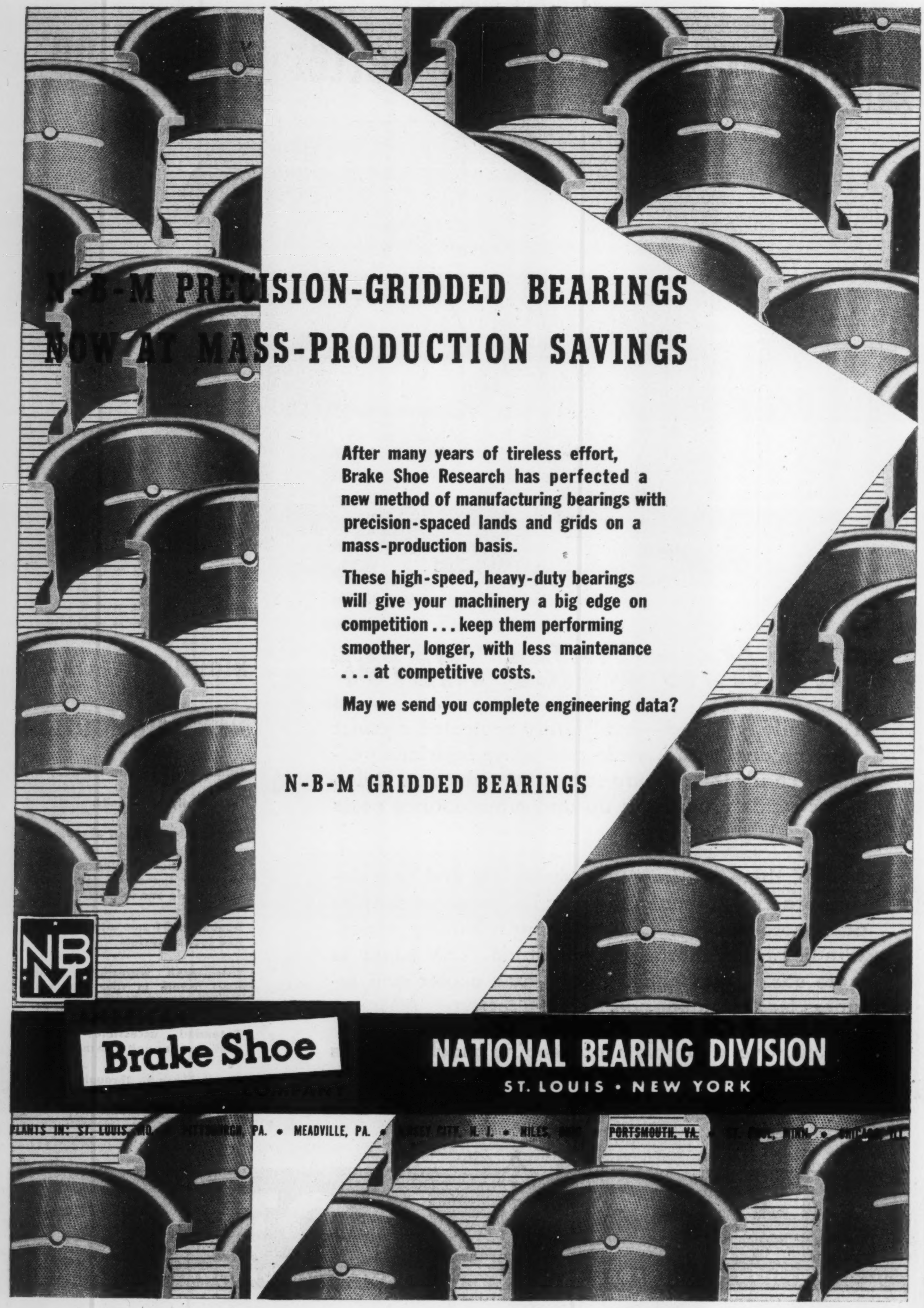
Extended, accessible mounting feet, cast as a unit with main frame.

From 1½-h.p. through 50-h.p.; NEMA frame sizes, 224 through 505.

DELCO MOTORS

DELCO PRODUCTS
DAYTON, OHIO

DIVISION OF GENERAL MOTORS CORPORATION



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NOW AT MASS-PRODUCTION SAVINGS

After many years of tireless effort, Brake Shoe Research has perfected a new method of manufacturing bearings with precision-spaced lands and grids on a mass-production basis.

These high-speed, heavy-duty bearings will give your machinery a big edge on competition . . . keep them performing smoother, longer, with less maintenance . . . at competitive costs.

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HELPFUL LITERATURE

FOR DESIGN EXECUTIVES

62. Electrical Insulation

Owens-Corning Fiberglas Corp.—6-page illustrated folder No. EL-47-19 presents promotional information, tips and suggestions in preparation for a showing of the 25-minute sound and colored motion picture "Watts In Glass." Picture is instructive and is intended for manufacturers in electrical industry, users of electrical equipment, technical groups and business associations.

63. Leather Products

Chicago Rawhide Mfg. Co.—32-page illustrated bulletin "Mechanical Leather, Synthetic Rubber" covers wide range of products such as aprons, belting, belt couplings and lacings, protective boots, leather valve disks, gaskets, gears, hammers, packings, etc. Sirvis leather products, Sirvene synthetic rubber products and Perfect oil seals are covered.

64. Small Motors

Redmond Co.—4-page illustrated folder "Redmond Micromotor" describes type U 1/20-horsepower electric motor which is equipped with Super-Life oil reservoirs, large bearings and flush-weld rotor. Motor operates at 1500 revolutions per minute; is of totally enclosed, 4-pole shaded pole type, and is $7\frac{5}{16}$ inches overall in length.

65. Graphite Bronze Bearings

Randall Graphite Products Corp.—12-page illustrated catalog No. GB43 presents information on line of standard types of graphite filled, grooved and drilled bearings. Bearings are tabulated by inside diameter, outside diameter, length and code number.

66. Dissimilar Metal Welding

Ampco Metal, Inc.—Procedure sheet entitled "Ampco Procedure for Welding Dissimilar Metals" describes use of Ampco-Trode 10 and Phos-Trode electrodes for this operation and gives detailed information concerning selection of electrodes, recommended amperage and voltage procedures, necessary heats, polarity and current requirements.

67. Speed Reducers

Ottumwa Iron Works—4-page illustrated folder No. 106 outlines features of type SR single reduction speed reducers that are fully enclosed, automatically lubricated and available for either right or left-hand operation. Tables are presented to aid in selection of proper speed reduction unit.

68. Clinch & Weld Nuts

Mount Clemens Metal Products Co.—40-page catalog "Engineering Data" describes clinch-on nuts, weld type nuts and other metal specialties. Diagrams illustrate units adaptable to almost any requirement. Information on special stampings and threaded metal fasteners is provided also.

69. Mechanical Rubber Goods

Automotive Rubber Co.—Two illustrated data sheets Nos. 500 and 750 deal with mechanical rubber goods fabricated by form dip process and rubber insulated metal parts respectively. Rubber protected metal parts can be of any shape or size and rubber coating can be applied without molds.

70. Counting Devices

Veeder-Root Inc.—110-page illustrated general catalog No. G-47 presents specifications and general operating data on a multitude of counting and computing devices. Typical standard, small square case, ratchet, geared and clutch speed counters are among units described.

71. Plastic Fabrication

G. Felsenthal & Sons—24-page illustrated catalog "Felsenthal Plastics" deals with information relative to molding and fabricating plastic parts from blueprint to product. Glossary of plastic raw materials used and methods of fabrication are discussed in detail. Subjects covered include molded electronic parts, signs, molded industrial parts, merchandise items, etc.

72. Alloy Steels

Jessop Steel Co.—12-page technical booklet describes Jessop stainless steels and heat resisting steels and gives chemical analyses, physical properties, corrosion resistance rating and fabricating properties of standard types.

73. Magnetic Controllers

Euclid Electric & Mfg. Co.—6-page illustrated bulletin No. 1016 includes dimensions, rating tables and general descriptive information on magnetic controllers that can be designed to specification to fit available space and have features required.

74. Laminating Resins

Plastics Div., American Cyanamid Co.—Illustrated booklet "Laminac Laminating Resins" describes applications already in production as well as potential uses for these plastic materials.

75. Snap-Action Switches

Unimax Switch Corp.—12-page illustrated catalog No. 47-6 deals with compact, snap-action precision switches that feature constant characteristics and interchangeability. Various Adaplate switch actuator styles are shown and their wide range of application is described.

76. Fastening Devices

Penn Engineering & Mfg. Corp.—4-page illustrated folder "Pem Self-Clinching Fasteners" gives specifications and general information on line of fastening devices which are designed for application where sheet metals are used. Application pressures vary from 1½ to 5 tons depending upon material. Fasteners can be applied to painted surfaces or plastics. Sizes are charted for reference.

77. Nickel Alloyed Cast Irons

International Nickel Co.—36-page illustrated booklet "Engineering Properties and Applications of Ni-Resist" gives detailed information on physical and mechanical properties of this cast nickel alloy. Performance under wide variety of industrial conditions involving corrosion, heat and wear is described. Corrosion data for 400 corrosive media are presented in tabular form.

78. Injection Molded Plastics

Plastic Engineering, Inc.—12-page illustrated bulletin describes research, design, engineering, mold making, production, finishing and assembling, inspection and shipping of injection molded plastics. Typical examples of custom molding and stock items available are shown.

FOR MORE INFORMATION

on developments in "New Parts" and "Engineering Department" sections—or if "Helpful Literature" is desired—circle corresponding numbers on either card below.

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15	35	55	75	95
16	36	56	76	96
17	37	57	77	97
18	38	58	78	98
19	39	59	79	99
20	40	60	80	100

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79. Coating & Adhesive Resins

Bakelite Corp.—4-page technical release No. 1 lists general characteristics and advantages of Vinylite resin VMCH which is suited for use as air-dried coating. Material is basically vinyl chloride-acetate resin resembling resin VYHH with the additional advantage of adhering well to many surfaces.

80. Gasket & Sealing Materials

Armstrong Cork Co.—20-page illustrated booklet "Armstrong's Gasket and Sealing Materials" contains suggestions for the selection and use of resilient sealing materials, chart of gasket recommendations for sealing various liquids and gases, and diagrams showing physical properties of different gasketing compounds.

81. Hydraulic Accumulators

Greer Hydraulics, Inc.—20-page illustrated booklet "Hydraulic Accumulators for Fluid Power" covers development of accumulators, typical applications, advantages and principles of operation. Also described are methods by which electric motors needed to pump hydraulic fluids can be reduced to minimize size by use of an accumulator.

82. Stainless Steel

Allegheny Ludlum Steel Corp.—36-page illustrated brochure No. SS10R-ED.1 describes uses of Allegheny metal in the dairy industry. In addition to specific applications in all branches of the industry, booklet covers technology of stainless steel, contains stainless steel selector and shows corrosion resistance chart for various media. Available forms of metal are listed and information on its fabrication are given.

83. Electronic Controls

Photoswitch Inc.—26-page illustrated catalog is compilation of numerous bulletins and data sheets describing electronic and photoelectric timers, level controls, electronic relays, smoke controls, counting devices, etc. General applications, specifications and diagrammed installation information are included.

84. Die Forging Tolerance Chart

Steel Improvement & Forge Co.—8½ x 11-inch chart is useful in determining commercial tolerances for closed impression die forgings. All essential factors required to determine commercial tolerances in forgings of any style, shape and weight up to 500 pounds are considered. Typical examples and instructions for use are included on reverse.

85. Porous Bronze Bearings

Bound Brook Oil-Less Bearing Co.—16-page illustrated bulletin "Stock List No. 3" lists stock oil-retaining porous bronze bearings available for immediate delivery. Included are new sizes of sleeve type, flanged and self-aligning bearings. Solid plugs and washers are listed also.

86. Wire Forms

E. H. Titchener & Co.—4-page illustrated letter presents information on typical wire forms and assemblies with strip steel. Plant views, and information on line of staples are given.

87. Aluminum Alloy.

National Smelting Co.—8-page illustrated bulletin entitled "Allcast Aluminum Alloy SC8" revised edition, traces history and outlines features and applications of this aluminum alloy material. Mechanical and physical properties and test results from production heats are covered.

88. Metal Strengthening

Rigid-Tex Corp.—6-page illustrated form No. 1RPM describes features and uses of Rigidized ferrous and nonferrous metals with perforations for industrial and ornamental use. Increased stiffness and impact strength in addition to variety of textures are features.

89. Brass Rods

Titan Metal Mfg. Co.—4-page illustrated folder describes large diameter brass rods and includes tables showing maximum lengths of rods in various diameters, composition of alloys in which they are furnished, and ASTM and SAE specifications for these alloys.

90. Voltage Controls

Superior Electric Co.—12-page illustrated bulletin No. 547 features latest developments in Powerstat variable transformers and Stabline automatic voltage regulators. Ratings, detail drawings, and performance and engineering data are included.

91. Welding & Brazing

Aluminum Co. of America—120-page illustrated loose-leaf catalog "Welding and Brazing Alcoa Aluminum" contains specific instructions for joining Alcoa aluminum alloys. Commercially important processes are given and needs of welder are discussed. Close-up photographs and tables of specifications are presented to define processes clearly.

92. Injection & Extruded Plastics

Elmer E. Mills Corp.—48-page illustrated brochure No. IV presents information relative to recently developed molding techniques which extend the uses of thermoplastic products. Parts design, plastic material and production data, plastic tubing and fittings, and thermoplastic materials commonly used are covered.

93. Reproduction System

Ozalid Div., General Aniline & Film Corp. —24-page illustrated booklet entitled "The Simplest Business System" No. SB10M647 describes methods for reproducing all types of business and engineering forms, photographic films and other material. Features of system and typical uses are described.

94. Small Metal Tubing

Superior Tube Co. — 4-page illustrated folder "Superior Fine Small Tubing in Many Metals" covers complete range of small metal tubing from 0.1 to 0.625-inch outside diameter. Both seamless and Weldrawn tubing are covered. Included is list of analyses available in carbon steels, stainless steels and nonferrous and glass sealing alloys.

95. Electric Motor Slide Bases

Overly-Hautz Co.—4-page illustrated bulletin describes line of all-steel adjustable slide bases for electric motors. Table of NEMA motor frame sizes from 203 to 505 is included and description of entire line including other sizes to specification is given. Lightness in weight and reduced mounting costs are features.

96. Forgings

Champion Machine & Forging Co.—4-page illustrated publication No. 1 is first of series of case histories relating information about cost reduction and quality control achieved by forging specific parts in closed impression dies. Elimination of costly machining in transmission part is featured in this issue.

97. Electrical Connectors

Scintilla Magneto Div., Bendix Aviation Corp.—16-page illustrated loose-leaf type catalog No. APC-1 presents data on complete line of electrical connectors and electrical connector accessories for aircraft, marine, automotive, transportation and communications industries. Specifications and dimensional data are included.

98. Hose Fittings & Sundries

United States Air Compressor Co.—12-page illustrated bulletin No. 47A describes line of hose fittings and sundries including Bowes couplings; Usaco pressure-seated air valves; Veribest air hose; grooved hose nipples; Never-slip hose clamps and Usaco hose menders, hose mender clamps, blow guns, spray guns, wire clamp tool and line strainer.

99. Variable Speed Transmissions

Lovejoy Flexible Coupling Co.—59-page illustrated loose-leaf type booklet covers lines of Ideal variable speed transmissions and L-R flexible couplings, in wide range of sizes and for wide range of industrial applications. Specifications, ratings, dimensions and recommended applications are covered.

100. Cold Finished Steel

Jones & Laughlin Steel Corp.—8-page illustrated booklet No. AD-99 describes new J & L Electreat heat treated cold finished steel. Features are uniformity, freedom from distortion, improved mechanical properties and minimum decarburization. Complete data and charts of various tests and properties are included.

M. D. Numbers

1	21	41	61	81
2	22	42	62	82
3	23	43	63	83
4	24	44	64	84
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PERMIT No. 36
(Sec. 510 P.L.&R.)
Cleveland, Ohio

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Reader's Service Dept.

"VEE-FLEX"
AUTOMATIC PACKING RINGS
SCHEDULE OF RING SIZES
SEND FOR THIS NEW BULLETIN
ON VEE-FLEX PACKING RINGS

The engineering department of Raybestos-Manhattan has recently prepared this bulletin on R/M Vee-Flex packing rings, Nos. 1203, 1204, 1205.

The text includes new data on dimensions, component materials and recommended uses, along with photographs and diagrams. Free copies of this bulletin are yours for the asking.

Vee-Flex rings are available in a wide variety of sizes and materials for use against water, steam, gasoline, mineral and vegetable oils, acids, milk, beer, wine, liquors, sewage, air, natural gas and other fluids and vapors.

Wherever used, Vee-Flex rings provide tight sealing and long service. They are specially recommended for rotating and reciprocating shafts on engines, pumps, hydraulic cylinders and other hydraulic equipment.

Put R/M Vee-Flex packing rings in your specifications and bill of materials for new equipment. For long-lasting, trouble-free operation, call in an R/M engineer to work with you on all your packing problems. He will be glad to cooperate with you and recommend packings for all types of equipment. Write Asbestos Textile & Packing Division, Raybestos-Manhattan, Inc., Manheim, Pa.

RAYBESTOS
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RAYBESTOS-MANHATTAN, INC.

ASBESTOS TEXTILE & PACKING DIVISION

Manheim, Pa. • Bridgeport, Conn. • North Charleston, S. C. • Passaic, N. J.

It's "Packed with Satisfaction" When You Use R/M

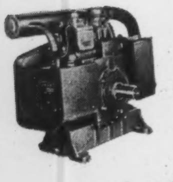
SMOOTH POWER

Two-Cylinder

The NEW ONAN

AIR-COOLED "CK" ENGINE

10 H. P. 4-CYCLE



Two-cylinder horizontal opposed design gives the new, heavy-duty CK engine unusual running smoothness. Short, rigid crankshaft . . . 2-inch diameter main and 1⅝-inch diameter rod bearings . . . pressure lubrication . . . axial-flow cooling fan . . . aluminum construction giving 4-to-1 cooling advantage over cast iron . . . weighs only 97 pounds and fits neatly into 15″ x 19″ x 18″ space. Designed to solve engine power problems in industry, agriculture and other fields. Proven by thousands in use today . . . now in mass production . . . prompt delivery.

Also has: Built-in precision governor . . . downdraft concentric carburetor for wide-angle operation . . . oil bath air cleaner . . . fuel pump . . . oil pressure gauge . . . crankcase fumes exhausted to carburetor . . . hermetically sealed magneto ignition coil with easy-to-get-at breaker points, 2-qt. oil capacity.

ONAN ELECTRIC PLANTS—A.C.—350 to 35,000 watts in standard voltages and frequencies; D.C.—600 to 10,000 watts, 115 and 230 volts. Battery chargers—500 to 3,500 watts, 6 to 115 volts.

ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 h.p.; BH: 2-cylinder opposed, 5.5 h.p.; 1B: 1-cylinder, 2.5 h.p.

Electric Starting

Built-in electric push-button or automatic starting is optional; adds little to overall dimensions. ⇨

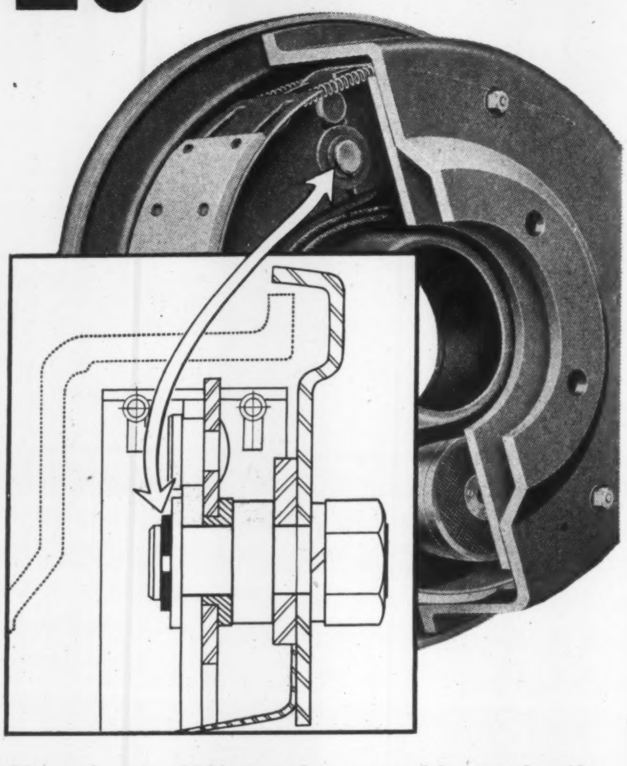
WRITE FOR COMPLETE SPECIFICATIONS

D. W. ONAN & SONS INC.
4341 Royalston Ave.
Minneapolis 5, Minn.

ONAN *4-Cycle* ENGINES

RETAINING RINGS CUT ASSEMBLY COST

25% plus, plus!

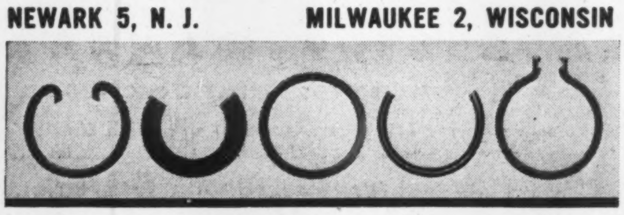


Not only was 25% saved in assembly cost but the additional savings included elimination of a nut, the threading of one end, and the cutting off of ⅜″ of an anchor pin in these fine Magdraulic Electric Brakes made by The Empire Electric Brake Company, Newark, N. J.

National Retaining Rings are being used more and more as smart postwar designers look over their products and machines to eliminate such needless waste as cutting down shafts to make shoulders. Instead, they groove their shafts and housings to apply these efficient yet inexpensive steel rings. No doubt you could save money and material too.

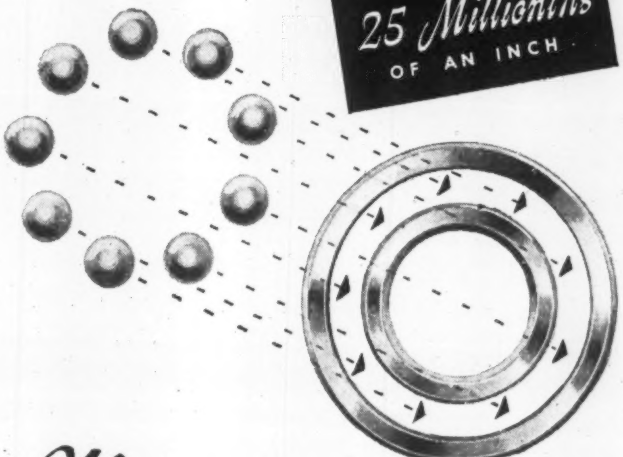
Write today for our retaining ring folders.

THE NATIONAL LOCK WASHER COMPANY
NEWARK 5, N. J. MILWAUKEE 2, WISCONSIN



Each CJB AHLBERG BALL BEARING *is equipped with a MATCHED SET OF BALLS...*

Accurate to *25 Millionths* OF AN INCH



The Balls in CJB Ahlberg Ball Bearings are hardened throughout—lapped and polished to mirror finish—accurate in sphericity to .000025″. Each bearing contains a matched set of balls identical in size to .000025″.

Whether the bearing is of deep groove construction for thrust capacity or the maximum ball type for extra radial capacity the balls are accurate to the "Nth" degree for smooth, quiet performance and long life. Without this extreme accuracy a bearing cannot be top quality.

Ahlberg Bearing Company, 3017 West 47th Street, Chicago 32, Illinois.

Ahlberg *Bearings* CHICAGO

BALL BEARINGS • ROLLER BEARINGS • PILLOW BLOCK

HOURS OF OPERATION?
DOWN TIME?
SERVICE NEEDED?

RUNNING TIME METER
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HOURS
THE R. W. CRAMER CO., INC. CENTERBROOK, CONN.
MADE IN U.S.A.

Cramer

RUNNING TIME METERS

PROVIDE ACCURATE ANSWERS AT A GLANCE !

• • • when used on any circuit, machine or system where reliable checks on operation are essential to production records, cost analysis.

CRAMER Type E Running Time Meters, for use on AC circuits, automatically and cumulatively register total operating or idle time. Forecasting parts replacement, service needed or other vital production data can be readily compiled. Compact, sturdily built in 3 styles to meet any requirement. Precision-built synchronous slow speed self-starting motor Model E7 illustrated has a five digit counter which can be reset to zero.

For complete facts on how the CRAMER Type E can be used as built-in or auxiliary equipment on your machines or processes, write us today.

THE R. W. CRAMER COMPANY, INC.
Box No. 6 • Centerbrook, Conn.

Plate and Filament Transformer
Blocking Oscillator Transformer
High Voltage Pulse Transformer
Power Transformer
Aircraft Power Transformer
Auto Transformer

Do *You* use Custom-Engineered Transformers?

MORE THAN 30,000 DIFFERENT DESIGNS of transformers have been engineered and built by the Transformer Department of Raytheon. The units illustrated are a small selection from the range of types and capacities produced.

All transformers for the famous SG and SO Radar equipment . . . employed under a variety of service conditions in all parts of the world . . . were designed and built by Raytheon. Many thousands of other transformers have also been designed and built to government specifications for military service.

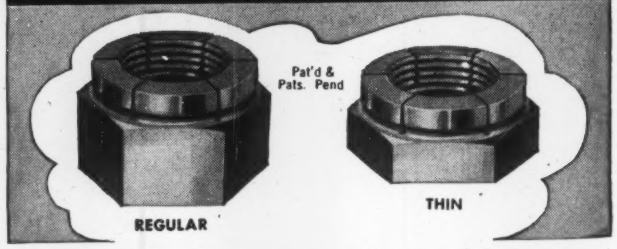
Raytheon employs a large engineering staff, maintains a model shop for producing sample units, and is building custom-engineered magnetic components to meet the specific service requirements of large and small manufacturers of electrical and electronic apparatus.

Your inquiry is invited. Detailed information on your requirements will receive the prompt attention of our transformer engineers.

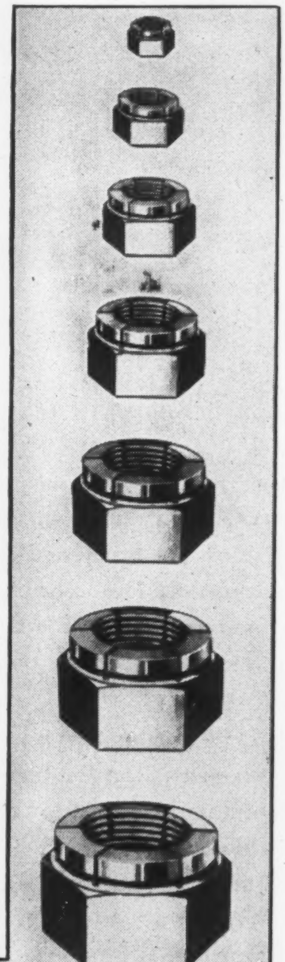
Address Dept. 4750-B

RAYTHEON
Excellence in Electronics
RAYTHEON MANUFACTURING COMPANY
COMMERCIAL PRODUCTS DIVISION
WALTHAM 54, MASSACHUSETTS
Industrial and Commercial Electronic Equipment, Broadcast Equipment, Tubes and Accessories
Sales Offices: Atlanta, Boston, Chicago, Cleveland, New York

FLEXLOC



SELF-LOCKING NUTS



Samples of our Flexloc Self-Locking Nuts will be sent free.

"Flexloc" packs maximum usefulness in minimum space because it is rugged, self-locking, compact—and is therefore becoming increasingly popular and this applies alike to U.S.S. and S.A.E. thread series.

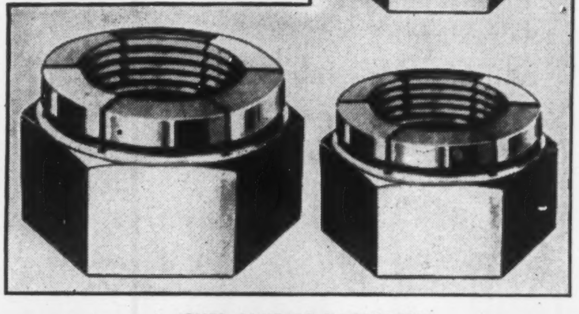
Every thread—including the locking threads—takes its share of the load.

Covers a wide range of tolerances—from low No. 1 to high No. 3. Can be used over and over again without losing much of its locking ability.

Being a "stop" nut, it stays locked in any position on a threaded member. "Flexloc" Thin Nuts are especially popular, because their tensile is so high.

Sizes from No. 6 to 1" in diameter—**millions in use!**

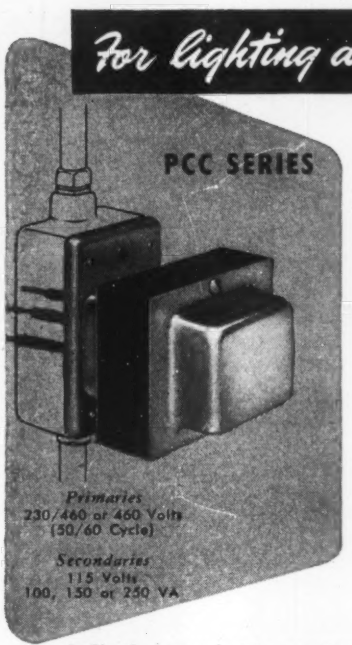
Convince yourself with a few free samples.



OVER 44 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.
JENKINTOWN, PA. BOX 102
BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

For lighting at machines...



SAVE CONDUIT, COPPER AND LINE LOSSES, ACHIEVE CLEAN-LOOKING INSTALLATIONS

with CHICAGO *Power Circuit* TRANSFORMERS

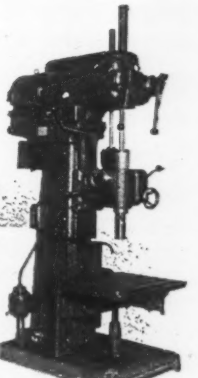
Eliminate unnecessary runs of 115-volt wiring to machine tools, welders, and other production equipment. Install these versatile transformers on the same 220 or 440-volt power line used for machine operation, and supply lighting and other 115-volt requirements up to 250 VA (continuous duty) with economy.

- *Simple, convenient to mount—will fit on any FD or FS-type conduit box.*
- *Secondaries fused for overload protection.*
- *High quality core and coil construction for long and dependable operating life.*
- *Durable cadmium plated finish on shields and cover.*

Write for prices and further details.

CHICAGO TRANSFORMER
Division of Essex Wire Corporation
3501 ADDISON STREET • CHICAGO 18, ILLINOIS

Your Coolant System is no better than the Pump that controls it



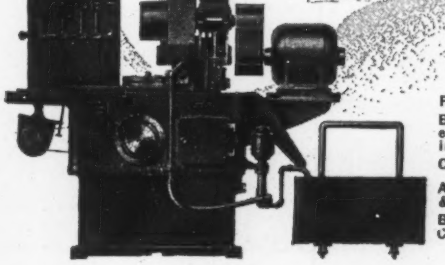
That is why so many machine tool builders have turned to the Ruthman Gusher Coolant Pump. They have learned by experience that Ruthman Pumps offer them numerous advantages which increase production and cut costs in metal-cutting operations.

Illustrated above is a Cleereman Drilling Machine equipped with a Model UL-7120 ¼ HP Ruthman Gusher Coolant Pump. Below is a Campbell 725 Auto Cutter equipped with a Model YLO-7.160 ¼ HP-1725 RPM Ruthman Gusher Coolant Pump.

Write for Catalog 10-C

1811 Reading Road Cincinnati, Ohio

THE RUTHMAN MACHINERY CO.

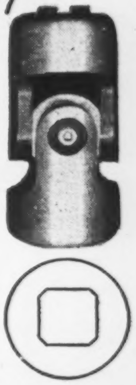


Photos Courtesy:
Bryant Machinery & Engineering Co.
Chicago, Ill.
American Chain & Cable Co.
Bridgeport, Conn.

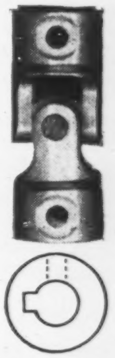
Memo

PURCHASING DEPT.

More economical to have Curtis machine special universal joints before assembly. Send them our blueprints



It saves man-hours and machine time to have joints shipped ready to install. Possible error or spoilage of joints in machining is eliminated.



Curtis can furnish forks to exact length required with hubs accurately turned, broached or bored for square, round, keyed or splined shafts. They have special jigs, equipment, and experienced craftsmen to do this work with the same precision and accuracy used in making standard Curtis Universal Joints.

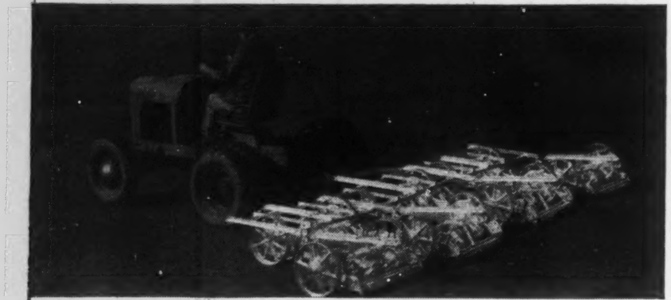
Be sure to send Curtis blueprints and specifications with inquiry or order.

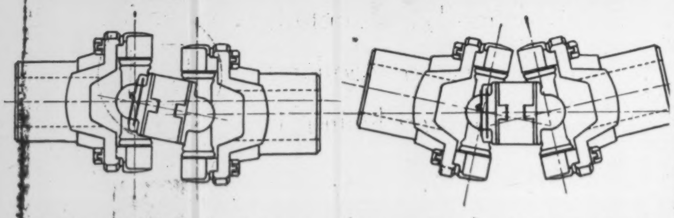
WRITE DEPT. B

CURTIS UNIVERSAL JOINT CO. INC. SPRINGFIELD MASS.

MECHANICS
Roller Bearing
UNIVERSAL JOINTS

For Close-Quarters and Out-of-Alignment Shafts



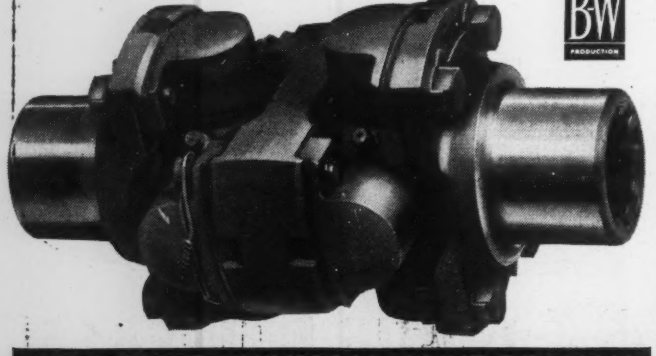


MECHANICS close-coupled type Roller Bearing UNIVERSAL JOINTS are specially designed for operation within cramped quarters, and where shafts are out of alignment. These joints fit into spaces that engineers formerly considerd too short for universal joints.

Unique features of MECHANICS Roller Bearing UNIVERSAL JOINTS make them unusually easy to install and service. The complete cross and bearing assembly can be removed simply by taking out the cap screws and separating the end yokes slightly. No flange is required for drive shaft connections. Accurately and durably built for long, heavy service, MECHANICS Roller Bearing UNIVERSAL JOINTS are inherently balanced for smooth operation.

Let our engineers show you how MECHANICS close-coupled Roller Bearing UNIVERSAL JOINTS will conserve space and compensate for offset shafts, in your new and improved models.

ENGINEERING BW PRODUCTION



MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner • 2026 Harrison Ave., Rockford, Ill.

ENGINEERED TO SPECIFICATIONS
POSITIVE FLEXIBILITY
DEPENDABLE ACTION
BUILT-IN SERVICE
STEWART QUALITY
CIRCLE

Flexible Shafts that carry power around any corner have many new uses in peace-time developments. Faithful, dependable power drives or remote control in airplanes, automobiles, radio, and many other commercial products.

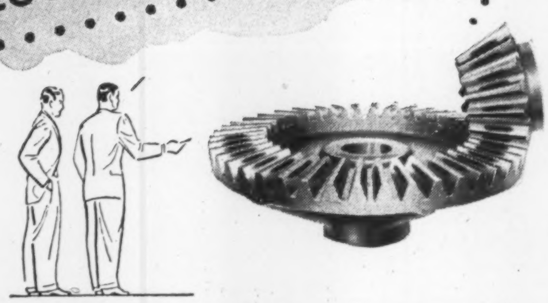
Shafts made to your specifications. Our engineering department will work out your particular power problem without obligation.

Write today for Manual X

F. W. STEWART MFG. CORPORATION
4311-13 RAVENSWOOD AVE. CHICAGO 13, ILL.
WEST COAST BRANCH: 431 Venice Blvd., Los Angeles 15, Cal.

CINCINNATI "*Coniflex*"

THE BEVEL GEAR *with* . . . LOCALIZED TOOTH BEARING



Cincinnati Coniflex gears make possible wider operating tolerance . . . allowing slight deflections in operation without dangerous concentration of the load at the ends of the teeth.

For smoother, quieter operation . . . localization of tooth contact in Cincinnati Coniflex Gears assures a good tooth bearing under operating loads.

For faster . . . easier assemblies look to Cincinnati Coniflex Gears

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio

This is it!

Amazing New Oil Filter offers TRIPLE capacity

the MARVEL Synclinal FILTER

By actual laboratory test, this remarkable sump-type filter keeps pumps, cutting tools, and cylinders moving because it operates at three times greater capacity. Faster oil flow at lower pressure gives longer, trouble-free operation. One idle machine of yours can break the back of a production schedule.

Multi-surfaced corrugations give filtering capacity of 3 like size units. Inserts interchangeable for various size apertures.

30 DAY TRIAL AT OUR RISK

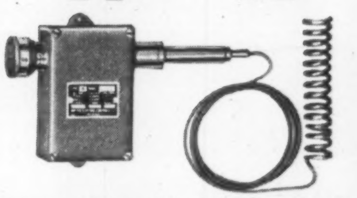
So certain are we of the remarkable performance of MARVEL SYNCLINAL FILTERS that we will accept orders for one or more filters on a 30 day trial basis. If YOU are not thoroughly satisfied, return for full refund. Write today for complete details.

Distributors Wanted. Choice Territories Open. Write Today.

MARVEL ENGINEERING COMPANY
629 W. Washington, Dept. 24, Chicago 6, Ill.

UNITED Electric Controls Company

type "K"



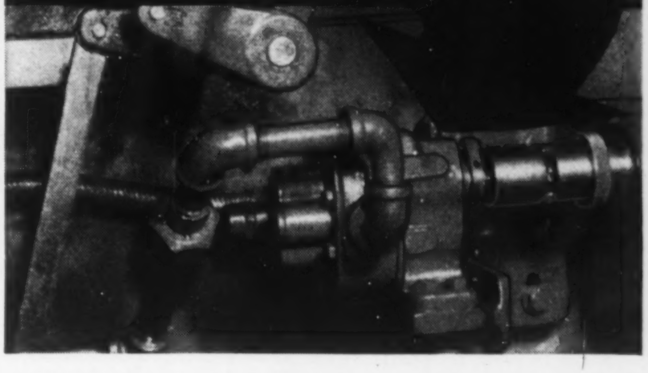
THE STANDARD THERMOSTAT FOR SPECIAL APPLICATIONS

THE Type K Thermostat is manufactured in five standard models having calibrated ranges of −120° F to 180° F, 50° F to 350° F and 50° F to 600° F. All models have micrometer adjustment, calibration correction, and effective ambient temperature compensation which permit accurate settings and control of temperatures in liquid, air and hot plate applications. The thermal assemblies of the Type K are the solid liquid-filled bellows, bulb and tube type. They may be had with stainless steel, mild steel or monel bulbs and capillary tubes for use in atmospheres injurious to copper or brass. Special models are available with watertight and explosion-proof housings.

FOR COMPLETE DETAILS WRITE: Dept. B, 69-71 A STREET, BOSTON, MASS.

Standard & Special Thermostats & Pressure Switches

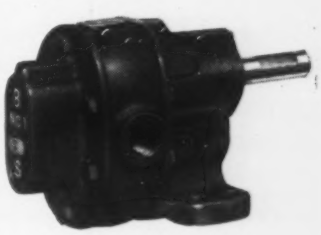
A PLUS FACTOR to consider in selecting PUMPS



Hundreds of pumps like these are in continuous operation in our own plant . . . under the watchful eyes of skilled machine operators, maintenance men, machine designers and engineers as well as pump specialists. Hundreds more are being installed on our new machine tools. Such installations provide practical, first-hand experience for determining the desirable characteristics that pumps require to give *you* satisfactory performance.

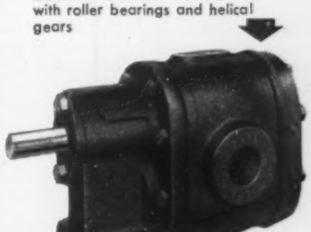
FOR COOLANT, GENERAL CIRCULATION AND LOW PRESSURE HYDRAULIC SERVICE, these pumps offer quiet, smooth performance at high speeds. Renewable iron bearings. Mechanical seal . . . prevents leakage and eliminates gland adjustments. Furnished with or without integral relief valves.

Nos. 1-S, 2-S, and 3-S ROTARY GEARED PUMPS with helical gears



FOR HYDRAULIC INSTALLATIONS—to supply oil under pressure. Extremely accurate helical gears run quietly at motor speeds. Although designed for direct drives, can be pulley or gear driven. Mechanical seal. Capacity, G.P.M. at 0 lbs. pressure: No. 53 — 4 to 23.3; No. 55 — 9 to 34.1.

Nos. 53 and 54 ROTARY GEARED PUMPS with roller bearings and helical gears

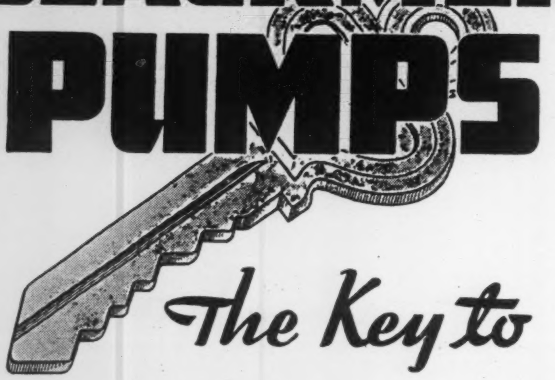


Write for catalog of complete pump line with detailed specifications and performance charts. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

GEARED • VANE • CENTRIFUGAL • MOTOR DRIVEN

BROWN & SHARPE PUMPS BS

BLACKMER PUMPS



the Key to

- LOWER PUMPING COSTS
- SUSTAINED PUMPING CAPACITY
- PUMP DEPENDABILITY

Write for Bulletin No. 307

FACTS ABOUT ROTARY PUMPS
BLACKMER

FACTS ABOUT ROTARY PUMPS

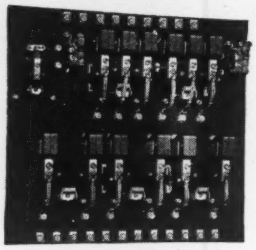
which explains why the "Bucket Design" (swinging vane principle) maintains pumping capacity by automatically compensating for wear and how the buckets, when finally worn out, are easily replaced and the pump restored to its normal capacity.

OUR ENGINEERS ARE AT YOUR SERVICE

BLACKMER PUMP COMPANY
1970 Century Avenue Grand Rapids 9, Michigan

POWER PUMPS · HAND PUMPS · EZY-KLEEN STRAINERS ·

EUCLID Magnetic Controllers



can be designed to your specifications as to available space and features required.

- Contactors can be arranged in 1 or 2 rows.
- Cabinets are designed to fit space available.
- Several controllers can be mounted in 1 cabinet.
- 2, 3, 4 or 5 speed remote control by means of Euclid push button master switches.
- Optional—overload relays, automatic acceleration relays, control circuit transformers, also dust-tight and weather-proof cabinets.

This magnetic equipment is available as single contactors, reverse panels and complete controllers. It is in use by many Crane, Hoist and Machinery manufacturers.

Write for Bulletin 1016-MD

THE EUCLID ELECTRIC & MFG. CO.
1335 CHARDON RD. EUCLID 17, OHIO

SIMPLE and EFFICIENT DIRECT DRIVE COUPLINGS

This exclusive direct drive coupling, with rubberized cushion gripped permanently by die-cast ends, has no parts to get out of order, or to lubricate. Minimizes misalignment, free end float, and backlash. Custom-made for specific job. Lengths from 2½" up. Bores $\frac{5}{16}$", ⅜", $\frac{7}{16}$" and ½". A million giving satisfactory service.

Write for sample and further details.

GUARDIAN PRODUCTS CORP.
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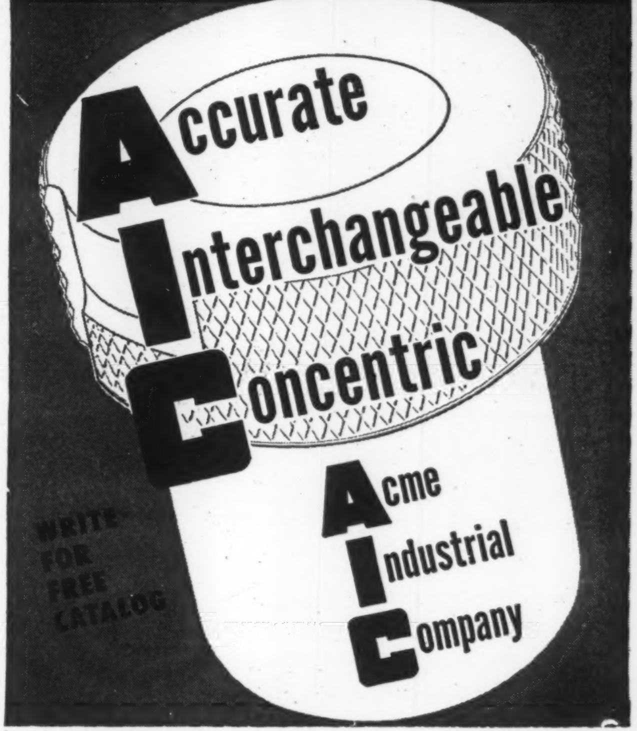
MICHIGAN CITY, INDIANA

DRILL JIG BUSHINGS


Accurate
Interchangeable
Concentric
WRITE FOR FREE CATALOG
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Every Rotating Part Needs BEAR DY-NAMIC Balancing

INCREASE EFFICIENCY!
MINIMIZE VIBRATION!
CUT MAINTENANCE!
BEAR
2235

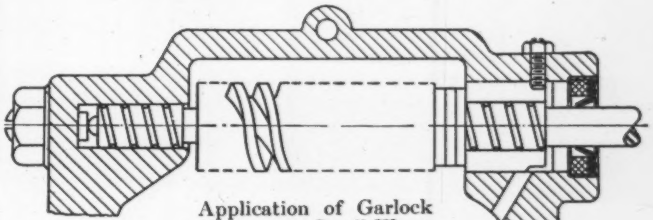
Send FOR THIS FREE BOOK FOR LATEST DEVELOPMENTS IN FASTER, SIMPLIFIED ELIMINATION OF THE

"WOBBLIES"

Experience has proven the practicality of dy-namically balancing every rotating part, from those weighing a few ounces to car wheels weighing tons! Investigate today the revolutionary Bear principle. See why it simplifies and lowers the cost of Dy-Namic Balancing. Write Bear Mfg. Co., Dept..A-4 Rock Island, Illinois.

BEAR
DY-NAMIC BALANCING MACHINES

Illustration shows Model 53 KLOZURE which is produced in a range of sizes for 3" to 10" shafts. Model 63 KLOZURES, employing the same engineering principals but differing in details of design, are made in a range of sizes from ¼" to and including 3" shafts.



Application of Garlock KLOZURE to Small Worm Drive Shaft.

Garlock KLOZURE

OIL SEALS (Models 53 and 63)

Extreme sensitivity and flexibility of these new Models 53 and 63 KLOZURES reduce friction to a minimum and provide an efficient seal even on shafts having considerable "whip" or lateral movement. They give superior performance on high or low shaft speeds. For use under various operating conditions and on many different kinds of equipment.

THE GARLOCK PACKING COMPANY
PALMYRA, N. Y.
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

60th Anniversary 1887—1947

GARLOCK

IT IS PRECISION-MADE . . . AND THAT'S IMPORTANT

TRU·LAY
PUSH-PULL
Controls

Every Tru-Lay Push-Pull unit is engineered and made to transmit back-and-forth movement with practically no back-lash. This means that it can be used in many applications—either for remote control or as a working part of a machine—where the ordinary "choke control" could not be considered. Made in any length with input capacities ranging from 30 to 1000 pounds.

DETROIT, MICH.—TRU-LAY PUSH-PULL units are working successfully up to 150 feet in length. Others with the equivalent of ten 90-degree bends. Such extremes serve to illustrate their wide range of usefulness.

Machine designers are constantly finding new applications for TRU-LAY PUSH-PULL. They find that, by allowing more freedom in the placement of units or accessories, TRU-LAY PUSH-PULL is a real aid in machine design.

If you are not thoroughly familiar with the possibilities of TRU-LAY PUSH-PULL, let us send you a copy of our descriptive booklet on the subject. Then, if you wish more specific information, our engineers will be glad to consult with yours.

ACCO

6-235 General Motors Bldg., Detroit 2
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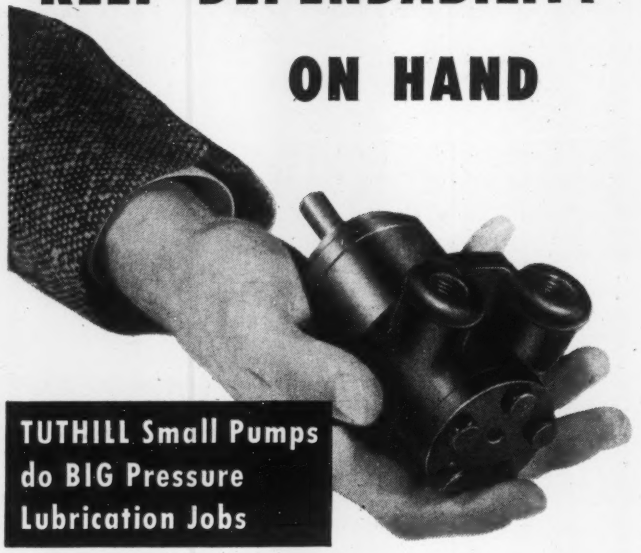
AUTOMOTIVE AND AIRCRAFT DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK *In Business for Your Safety*

KEEP DEPENDABILITY ON HAND



TUTHILL Small Pumps do BIG Pressure Lubrication Jobs

For all its small size, the Tuthill Model L pump does a whale of a job in pressure lubrication and hydraulic service. This internal-gear rotary pump is mechanically sealed and built in capacities up to 3 g.p.m. in pressure ranges up to 400 p.s.i. Ring or foot mounting. Many porting arrangements. Write for bulletin on Tuthill small industrial pumps.

TUTHILL PUMP COMPANY
939 East 95th Street, Chicago 19, Illinois

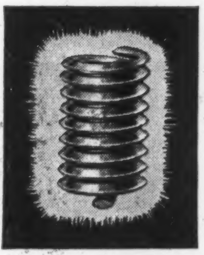
DON'T REJECT PARTS WITH STRIPPED THREADS

—salvage them with

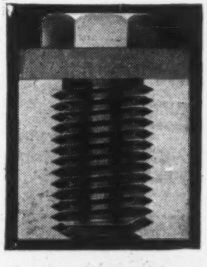
HELI-COIL* INSERTS

Through the use of Heli-Coil Inserts many manufacturers have eliminated costly rejections of parts in production due to poorly tapped or stripped threads. It is a simple salvage operation—just drill out the damaged thread, retap the hole and install the insert with a simple hand or power inserting tool.

Heli-Coil Inserts are also extensively used in original manufacture, notably in the principal aircraft engines, where a strong, durable tapped thread is desired. They are used in light metals, plastics and many other structural materials. Their use in the maintenance of automobiles and many other mechanical products has also become well established. Consult us on your problems.



(Upper) The Heli-Coil Insert, of stainless steel or phosphor bronze, provides a durable tapped thread surface.

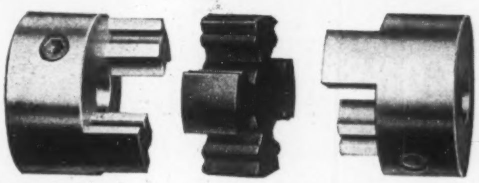


(Lower) Above sectional view shows completed assembly with Insert installed.

ENGINEERING REPRESENTATIVES
IN PRINCIPAL CITIES
*Reg. U.S. Pat. Off.

HELI COIL **AIRCRAFT SCREW PRODUCTS COMPANY, INC.**
47-23K 35th STREET • LONG ISLAND CITY, 1, N.Y.

A NEW PRINCIPLE IN . . . . FLEXIBLE COUPLING DESIGN



The exclusive tongue and groove design of Climax Type C Flexible Couplings reduces extrusion, backlash and noise. This feature produces a greater area of contact between jaws and inserts, giving increased capacity and provides for the maximum of flexibility and shock absorbtion. They are easy to install. No special tools are required for lining them up. Inserts are Neoprene.

Climax Type C couplings are made in six sizes for shafts from ¼" to 1⅝" and horsepower capacities from 1/6 to 12 at 1750 RPM.

OTHER TYPES FOR DRIVES
UP TO 1700 HORSEPOWER

Many special designs available to meet all your coupling requirements.

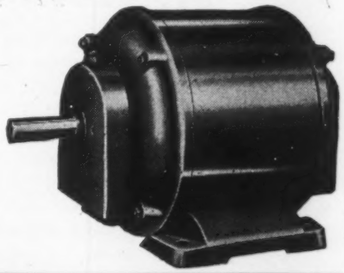
THE CLIMAX FLEXIBLE COUPLING CO.
863 EAST 140th ST. • CLEVELAND 10, OHIO

Design Engineers Specify

VALLEY
Ball Bearing
MOTORS

Because-

- They offer more flexibility in power planning.
- They are built to meet unusual power loads and high temperatures.
- They meet all operating conditions where hazards of liquids, chips, etc., dropping into the motor are involved; as well as splash conditions.
- Being made in ½ to 75 h. p. sizes, they offer wide adaptability.



VALLEY
ELECTRIC CORPORATION
4221 Forest Park Blvd. • St. Louis 8, Missouri

SMALL... extra payload SIZE

THAT'S an exact description of these BCA ball bearings. BCA designed them specifically for the transmission of the Bell Helicopter. They are assembled in matched pairs on the shafts of the first and second planetary gears to take radial and thrust loads in either direction. Each of these BCA ball bearings is smaller than a silver dollar, yet they withstand service conditions that normally call for considerably larger bearings. Inner and outer races are matched to 1/10,000 of an inch.

Whether your applications call for custom built or standard ball bearings, get in touch with BCA—industry's headquarters for soundly engineered ball bearings since 1897.

BCA **BEARINGS COMPANY OF AMERICA**
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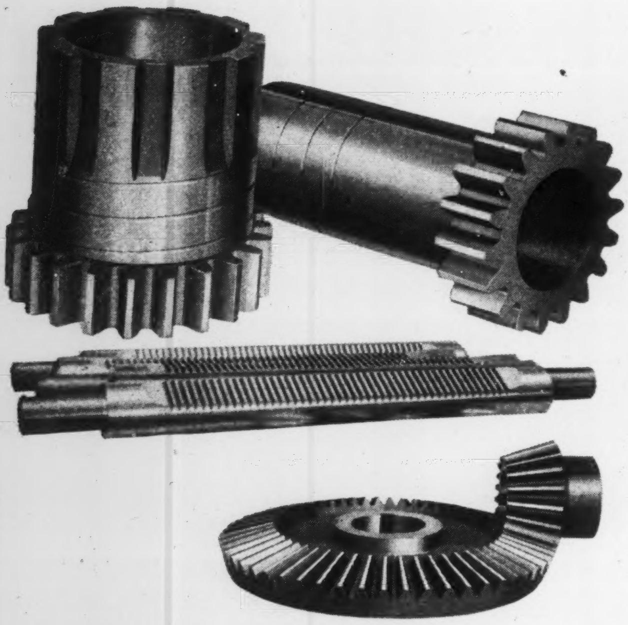
BCA RADIAL · ANGULAR CONTACT · THRUST
BALL BEARINGS



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GEARS
made exactly to
your specifications

Regardless of quantity or type, you'll profit by specifying Adams custom made gears for your product. Made on the most modern gear cutting machines by skilled workmen, Adams gears are quality controlled to guarantee exact conformance to your specifications. Write for further information, today. THE ADAMS COMPANY, 1942 Market St., Dubuque, Iowa.

Spur Gears
Helical Gears
Bevel and Miter Gears
Worms and Worm Gears
Internal Gears (spur and helical)
Sprockets
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Splined Shafts
Racks
Lead and Feed Screws
Ground Tooth Gears (spur and helical)
Shaved Tooth Gears (spur and helical)
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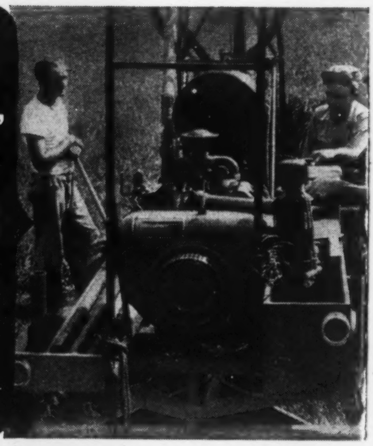
The ADAMS Compa
Dubuque, Iowa, U. S. A.
ESTABLISHED 1883

GEARS

FINE GEARS MADE TO YOUR SPECIFICATIONS

Core Drilling
is "Duck Soup"
for this
WISCONSIN
HEAVY-DUTY
Air-Cooled
ENGINE
★

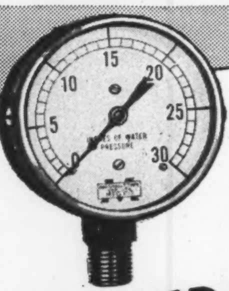


The picture shows a Model VE4 Wisconsin V-type, 4-cylinder Air-Cooled Engine powering a Casperson Core Drilling Unit, engaged in oil field exploratory work.

This engine, weighing in at 295 lbs., turns up 22 hp. at 2600 rpm. and is built for rugged, heavy-duty service. It is equipped with Timken tapered roller bearings at both ends of the crankshaft to assure fullest protection against bearing failure under continuous, full-load operation and to take up end-thrust.

Core Drilling is "duck soup" for this engine . . . just one of any number of jobs Wisconsin Air-Cooled Engines are handling with top efficiency, operating economy and heavy-duty dependability.

Most H.P. per pound
WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN, U. S. A.
World's Largest Builders of Heavy-Duty Air-Cooled Engines



LOW PRESSURE DIAPHRAGM GAUGE

MARSHALLTOWN

Figure 83 is a very sensitive instrument utilizing a diaphragm for pressure communication, and is recommended for extremely low pressure service.

The following standard dials reading in inches of water are available—0-15", 0-30", 0-60", 0-100", 0-150".

Ounce graduated dials can also be supplied in a range from 16 ounces to five pounds.

It is available in the 2½", 3½", and 4½" dial sizes and mounted in a black enameled, deep steel case. Write for details and price.

MARSHALLTOWN

manufactures one of the most complete lines of indicating pressure gauges—there is a Marshalltown gauge for every purpose and pressure.

Marshalltown Mfg. Co., Marshalltown, Iowa

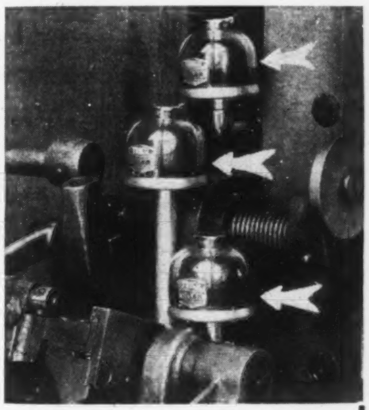
BEARING PROTECTION
against
COSTLY HUMAN ERROR

Your machines can die very young if oiling of bearings is left to human error.

TRICO
Visible-Automatic
OILERS

stop "trust - to - luck" hand-oiling and assure your customers of . . . .

- Maximum machine life
- Greater efficiency
- Increased production
- Safety against fire & accidents
- Visible Oil supply
- Savings in labor—power—lubricants



Hundreds of thousands of TRICO Automatic OILERS have been installed by leading Machine Builders. You, too, can add greater value to YOUR machines. There's a type and size for practically every application . . .

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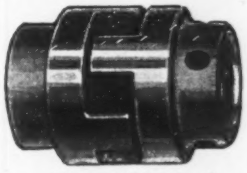
TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

POWER *Flow*

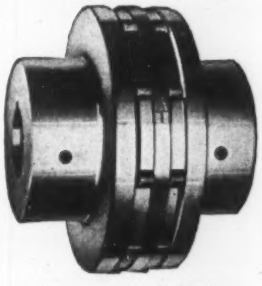
ONLY AS TRUE, DEPENDABLE AND *EFFICIENT* as its COUPLING



Pat. and Pats. Pend.
From Type "A" for fractional h.p. to 50 h.p.

to

Type "W" for heavy duties, to 2500 h.p. and weighing from 9 to 3000 lbs.



Pat. and Pats. Pend.

LOVEJOY L-R
Flexible Couplings

Resilient Alignment Types *simplest,* most rugged insurance of true performance—correction for misalignment, takeup of shock and vibration, backlash, chatter, etc. The *quiet couplings!* Send for complete catalog, with Selector Charts for quickest finding of couplings you need.

LOVEJOY FLEXIBLE COUPLING CO.
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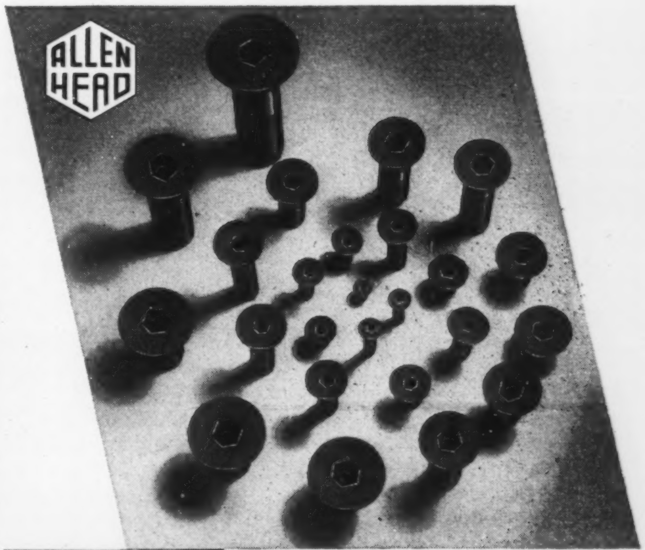
Also mfrs. of Lovejoy-IDEAL Variable Speed Transmissions



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ALLEN
FLAT HEAD
CAP SCREWS

For perfect countersink-fit; positive wrenching—and more!

(1) Flush top surface with no gap between screw head and surrounding metal.

(2) Extreme rigidity of grip, because angle of head helps lock screw in place by drawing down on a conical surface.

(3) Firmer hold on thin plates of metal, by more binding surface under the head than in fillister type or cheese-head screws.

(4) Shallower countersink — less weakening of metal — when used for fastening a relatively thin plate.

(5) Positive engagement of hex key transmits power for tightest of set-ups without slipping, reaming or side play.

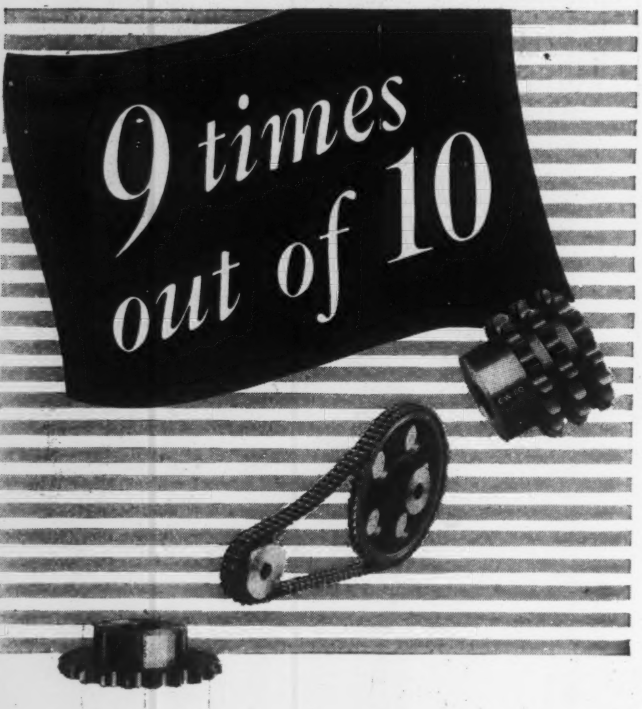
(6) Maximum strength of screw itself assured by *"pressur-forming"* of special-analysis ALLENOY steel. Threaded to a high Class 3 fit.

(7) Speed in assembly provided for by use of Allen hand drivers and key blades for power drivers.

Order of your local ALLEN Distributor, — or ask him for samples and engineering data for preliminary try-out. Get *proof* that these screws perform as dependably as Allen Hollow Set Screws and Socket Head Cap Screws.

TRADE MARK

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, . . CONNECTICUT, U. S. A.



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will do the job—Better!

With 2,000 types to select from—you are almost certain to find just the size you need for practically every transmission requirement—ready for immediate delivery. Cullman Sprockets—produced by fast, low-cost, high-precision methods —asssure top operating efficiency. "Specials," too, *are quickly available*—made up by exclusive Cullman methods and specialized equipment.

CULLMAN
SPROCKETS

Write today for free catalog containing useful data and helpful facts for sprocket users. It lists dimensions.

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1336 Altgeld Street Chicago 14, Illinois

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A Quality Seal for Quality Products

The engineering design and precision manufacture of every "Sealol" mechanical seal means unsurpassed sealing for your product. "Sealol" seals any rotating shaft at high or low speeds, against a wide range of pressures - its balanced pressure feature controls seal face pressure and minimizes frictional heating and power loss. The only relative movement in the seal is at lapped faces — "Sealol" is sure in action, long-lived, and dependable.

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SEALOL CORPORATION
45 WILLARD AVENUE • PROVIDENCE 5, R. I.
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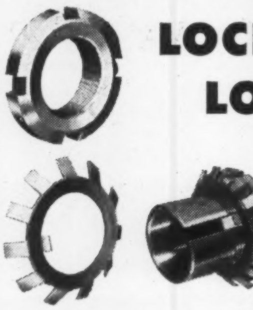


LOCKNUTS, LOCKWASHERS and ADAPTERS

Order now from our complete stock of Locknuts, Lockwashers, and Adapters for your application of ball and roller bearings . . . S.A.E. Standard . . . A.B.E.C. Standard . . . Heavy-duty and Specials.

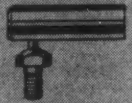
Locknuts in sizes N-00 through An-40, and new multi-prong type Lockwashers in sizes W-00 through W-40 can be delivered immediately. (Write for Bulletin 27 containing complete specifications.)

Adapter sizes 7-9-11-13 . . . for shaft sizes $1\frac{3}{16}$"-$1\frac{7}{16}$"-$1\frac{15}{16}$"-$2\frac{3}{16}$".

STANDARD LOCKNUT & LOCKWASHER, INC.
311 N. Capitol Ave. Indianapolis, 4, Indiana

TOUREK

BALL JOINTS



the recognized standard!

Years of experience in filling the needs of industry has enabled Tourek to develop a line of stock types and sizes of ball joints that meets virtually all requirements.

In those instances where special types are necessary, Tourek engineers and designers provide manufacturers with an invaluable source of expert assistance.

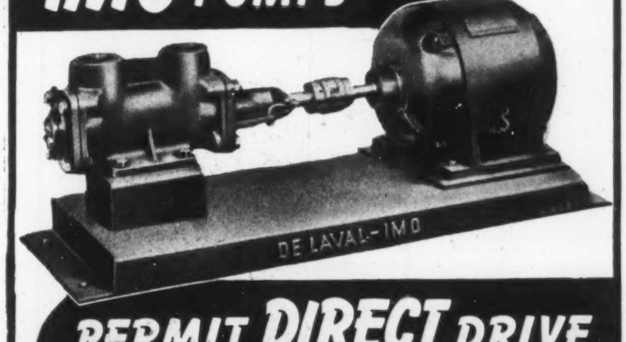
Tourek can supply your most exacting requirements for ball joints. Illustrated catalog showing stock types will be sent on request. Requests for information on special types will receive prompt attention.

J. J. TOUREK MFG. CO.
4701 West 16th Street, Chicago 50, Illinois

MAKERS OF PRECISION SCREW MACHINE PRODUCTS

ESTABLISHED 1920
TOUREK
FAMOUS BALL JOINTS

IMO PUMPS



PERMIT *DIRECT* DRIVE AT ANY SPEED

The IMO pump can be connected directly to turbines, motors or other machinery without the use of reduction gears.

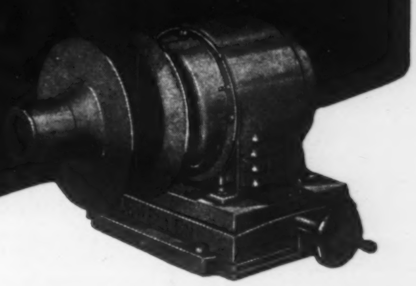
Operated at high speed, it is exceptionally small and compact in proportion to its capacity.

IMO pumps can be furnished for almost any capacity and pressure required for pumping oil, hydraulic control fluids and other liquids over a wide viscosity range.

For further information send for catalog I-138-D

IMO
PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

Watch production MOUNT



when your fixed-speed machines have Lewellen *Variable-Speed* Motor Pulleys

1 **SPEED ADJUSTABILITY.** Regulate the speed of your machines by the simple turn of a Lewellen handwheel *without stopping the machine.* Have the *right speed at the right time!*

2 **MAXIMUM MACHINE OUTPUT.** Check the rated capacities of your machines with actual production output. Often what a machine can do is simply a matter of its operation at the correct speed.

3 **PRODUCT UNIFORMITY.** Actually the lack of uniformity in materials and varying conditions in plants demand speed adjustability of production machines for uniform, quality work.

4 **UNINTERRUPTED SERVICE.** Avoid the waste of time to change belts and gears. Keep production flowing smoothly.

5 **MINIMUM SPOILAGE.** Adjust machine speeds to equal the skill of operators—change in materials, and costly rejects are reduced to a minimum.

6 **FACTORY SPACE SAVED.** Lewellen Variable Speed Motor Pulleys are compact—modern in design. Often valuable space is saved by their use.

Back of each Lewellen Variable-Speed Motor Pulley is more than 45 years experience in speed-control engineering. Lewellen Variable-Speed Transmissions, Variable-Speed Motor Pulleys and Automatic Controls are in use the country over.

EXPECT REMARKABLE RESULTS! With the proper size Lewellen Pulley you can drive a machine at infinitely variable speeds; connect directly between the motor and the machine; operate the driven shaft at desired speeds. And, think what a saving it means to operate your production machines at the CORRECT SPEED! There is a Lewellen Pulley for your motor horsepower and speed, for all ratings from fractional to 7½ h.p. The speed range is 3 to 1 for all pulley sizes. (One size has a speed range of 2¾ to 1.) **Call your Lewellen representative or write today for complete information.**

LEWELLEN MANUFACTURING CO., COLUMBUS, INDIANA

★ **Lewellen knows speed control**

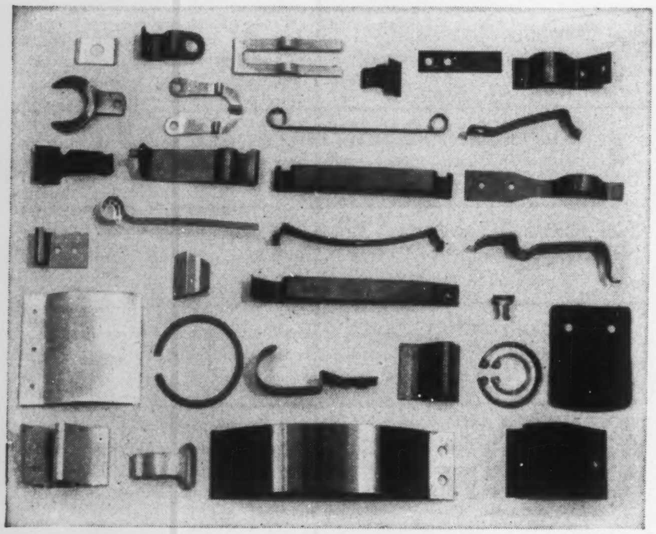
A WAY TO CUT YOUR SPRING COSTS!

Reliable

Wide variance in spring prices can easily arise from latitude in interpreting loose specifications, rather than from your producer's failure to know his own costs. Most spring manufacturers are experts on costs. Price differentials on any given spring are often really the result of "cutting corners", which adversely affects the quality of your spring.

All industry is now likely to become more cost conscious. If you are "paying through the nose" for submitting to your spring sources inadequate, contradictory, or unclear specifications—do something about it! For if your price inquiries, specifications and prints are in workable shape at the outset, you always save money—and you should then get full value, full quality, for the price you pay. Reliable specializes in precision manufacturing of all types of springs, wire forms and light stampings—but we can do more for you with precise specifications.

As a guide on vital spring information, write for Bulletin, "Buying the Right Springs Right".



The Reliable Spring & Wire Forms Co.

3167 Fulton Rd., Cleveland 9, Ohio

Representatives in Principal Cities

YOU CAN RELY ON

Reliable Springs

ROUND AND FLAT WIRE SPRINGS CLIPS HOOKS BENDS LIGHT STAMPINGS

VIKING

The MARK OF A GOOD RELIABLE ROTARY PUMP

VIKING PUMPS — THE ORIGINAL "GEAR WITHIN A GEAR" — JUST 2 MOVING PARTS — REG. T.M. IN U.S.A. — VIKING PUMP CO. CEDAR FALLS, IOWA

Look for this registered trade mark and the name VIKING on all your rotary pumps. It is your assurance of a good, reliable pump for handling all clean liquids regardless of viscosity.

It means you have a pump based on the design of more than a million others. Built from sound rotary pump experience and know-how unsurpassed in the field.

Look to Viking, the rotary pump manufacturer who builds to serve you now and in the future. Be safe. Be sure. Buy Viking. Write today for free bulletin 46SH.

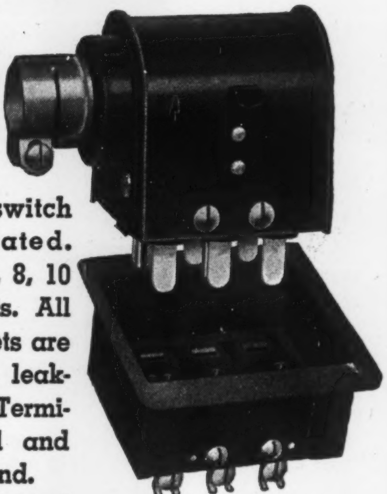
See Our Catalog In SWEETS

VIKING Pump COMPANY CEDAR FALLS, IOWA

JONES 500 SERIES PLUGS AND SOCKETS (HEAVY DUTY)

Designed for 5000 Volts and 25 amperes per contact. Socket Contacts are of phosphor bronze, knife switch type, silver plated. Made in 2, 4, 6, 8, 10 and 12 Contacts. All Plugs and Sockets are Polarized. Long leakage path from Terminal to Terminal and Terminal to ground.

Caps and Brackets are of steel, parkerized. Plug and Socket blocks interchangeable in Caps and Brackets.



Plug P-506-CE
Socket S-506-DB

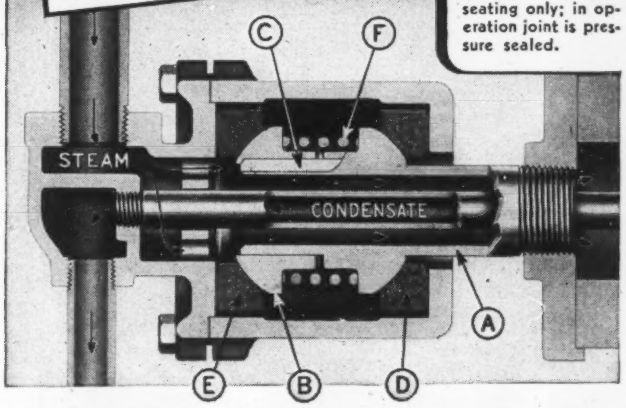
This series is designed for heavy duty electrical work and will withstand severest type of service. Accessibility a feature. Write for Bulletin No. 500 describing this line of Heavy Duty Plugs and Sockets. Also ask for general catalog No. 14.

HOWARD B. JONES DIVISION
CINCH MFG. CORP.
2460 W. GEORGE ST. CHICAGO 18

GOT A JOB FOR JOHNSON JOINTS?

You have if you're faced with a problem that involves getting steam or liquids into rotating machine parts. The Johnson Rotary Pressure Joint is completely packless, self-oiling, self-adjusting, and even self-aligning. Industry has already put 100,000 to work, in barely ten years. Type B shown provides for condensate removal; other types and sizes for all needs. Write for details.

Nipple (A) connected to roll or drum. Sliding collar (B) keyed (C) to nipple. Carbon - graphite seal ring (D) and bearing ring (E) eliminate oiling and packing. Spring (F) is for initial seating only; in operation joint is pressure sealed.



THE JOHNSON CORPORATION
811 Wood St., Three Rivers, Michigan

ROCKFORD

LIGHT OVER-CENTER CLUTCHES

- COMPACT DESIGN
- POWERFUL PULL
- SMOOTH ENGAGEMENT
- UNIFORM PRESSURE
- FINE ADJUSTMENT
- ACCURATE BALANCE
- LONG SERVICE LIFE*

* The strong, symmetrical body, release sleeve and bearings are accurately machined. Clutch plates, operating pins, links and rollers are hardened steel. Facing is specially selected for long-wear, non-grab qualities. Driving pressure is uniformly distributed, directly opposite the facing. Fine adjustment promotes smooth operation and long life.

SEND FOR THIS HANDY BULLETIN

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
311 Catherine Street, Rockford, Illinois, U. S. A.

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CROWN JEWELS ARE HERE

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WITH A CAPITAL "T" FOR TRULY

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But Transparency isn't the only reason for the popularity of this tracing cloth. It also gives you maximum erasability with minimum feathering. Why not try PEL-X — now, today? PEL-X, water-repellent, white pencil tracing cloth is at your dealer's *now*.

FOR BETTER PLANS...
Better Plan on PEL-X Tracing Cloth.

WHITE PENCIL PEL-X WATER REPELLENT TRACING CLOTH

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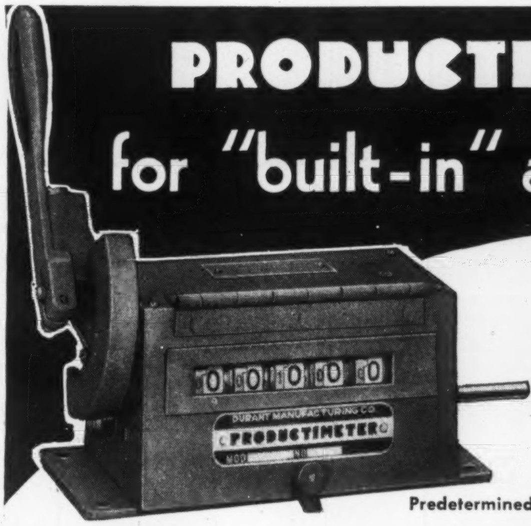
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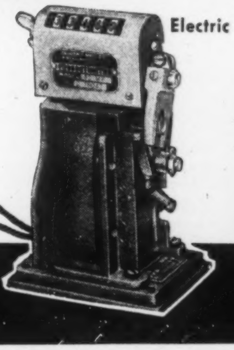
When you're designing production machinery . . . look to Productimeter counters for automatic production count! Choose from a wide range of types and models . . . or let us develop a counting unit to meet your particular requirements.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Manufacturer states,
"Re-lubrication
now a matter
of seconds"
with

GITS BALL VALVE OILERS

Precise Products Co., Racine, Wis., acclaims the GITS Ball Valve Oiler, writing: "These efficient self-sealing oilers have facilitated the re-lubrication of our 40,000 RPM electric handtools to such an extent that the failure of ball bearings has been reduced to a negligible number. In our former model . . . handtool this operation required more than fifteen minutes of a skilled mechanic's time."

In hundreds of cases like this, manufacturers have discarded the old "hole-in-the-housing" which freely admitted grit and dirt—specifying self-sealing GITS oilers for complete and permanent bearing protection.

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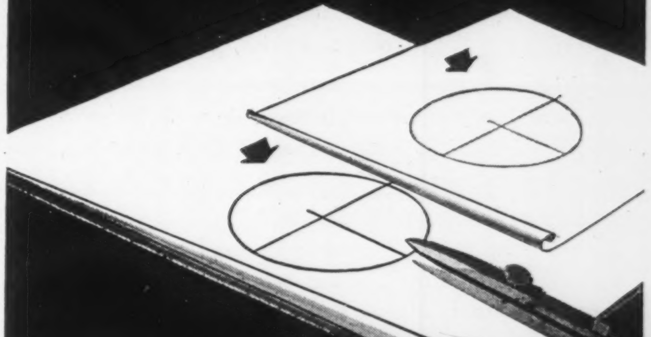
TRACING CLOTH THAT DEFIES TIME



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If you like a duller surface, for clear, hard pencil lines, try Imperial Pencil Tracing Cloth. It is good for ink as well.

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Single Tube

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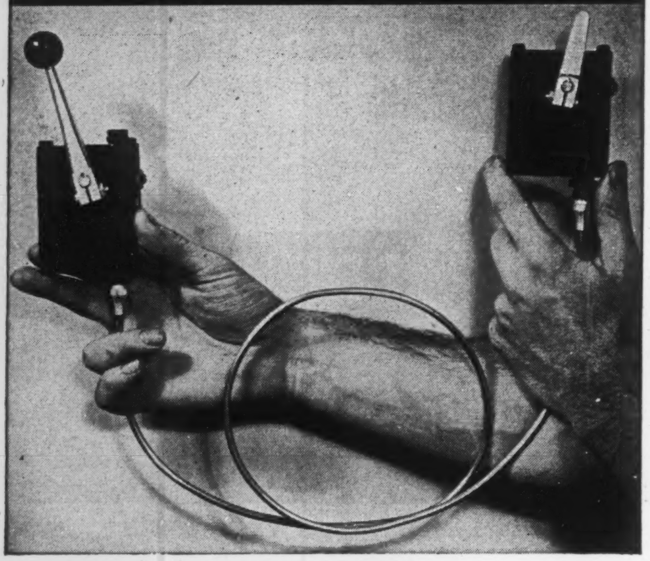

Here's a tiny — almost miniature — Sperry Control System that's:

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A single flexible copper tube connects receiver and transmitter... does away with design limitations imposed by use of old-fashioned link rods and bell cranks, pulleys and control cables, etc.

EASY-TO-OPERATE

Balanced system permits operation with fingertip pressure — smooth, even action without time lag, without backlash.

ACCURATE AND DEPENDABLE

Accuracy of ¼ of 1 degree through an effective operating arc of 60°. Water-proof, corrosion-resistant, dust-proof, it's as dependable as the larger units long manufactured by Sperry.

Write for Bulletin 2400-H or for information on your particular problem. SP-102

Dealer Inquiries are also Invited.

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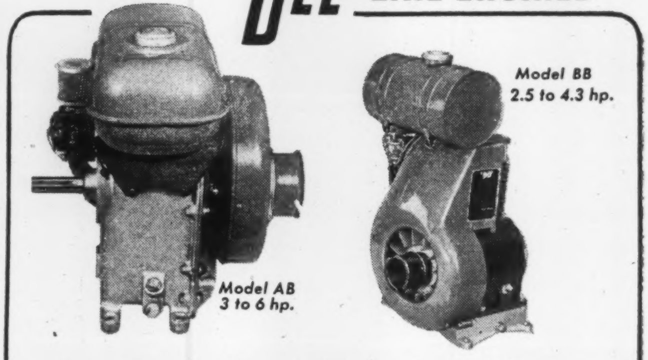

In Volume Production

Prompt Delivery

These 4-cycle, air-cooled gasoline engines are thoroughly service-proved in many applications. Light weight, compact design, and wide power range mean ready adaptability to many types of equipment and powering problems. Backed by 28 years of engine building experience, including manufacture of the famous Kinner aircraft engines.

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The FLEX V TRADE-MARK

Belt Fastener for A and B Belts of open end construction

Size No. A180 for A Belts
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Flex V fasteners are made in two sizes for joining A and B V-belts of special open-end cross-woven fabric construction and on drives rated as light duty with a belt speed of not over 3000 feet per minute. The fasteners must not be used on heavy duty or high speed drives or for joining or repairing V-belts that were originally endless.

Flex V fasteners are easy to apply with the special applicator tool. The separable hinge joint makes for quick replacement of V-belts without dismantling shafting or machinery. Flex V fastened V-belts can also be run on V Flat Drives for there is no metal on the under side of the belt to contact the flat faced pulley.

Folder No. V-12 gives complete details on this Flex V fastener with list prices, special tools and application information. Your request will bring a copy.

Order from your supply house

FLEXIBLE STEEL LACING CO.
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Also sole manufacturers of Alligator Steel Belt Lacing for flat transmission belts. Alligator V-belt Fasteners for V-belts and Flexco HD Belt Fasteners and Rip Plates for fastening and repairing conveyor belts.

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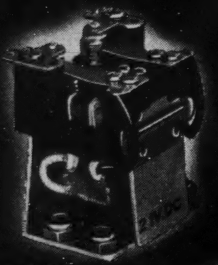
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FOR WIDE ADAPTABILITY

These Amrecon multiple purpose relays are designed for either A.C. or D.C. operation. Each is available in a variety of contact combinations and capacities. Most units are available in light and heavy duty contacts nominally rated from 5 to 15 amps., 115 volts A.C., noninductive. Others are rated as high as 50 amps., at 115 volts A.C., noninductive. The relays illustrated are but a few of our many types. We can supply special relay units made up of Amrecon precision components to meet your most exacting relay requirements. We are especially well equipped to assist you in your engineering problems with respect to relay application.

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Write for our 4-page illustrated booklet.

Offices in principal cities

American Relay & Controls, Inc.

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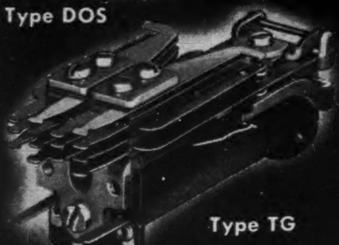
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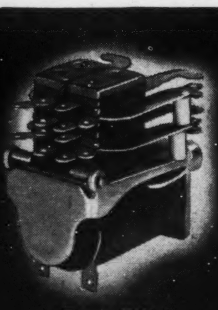
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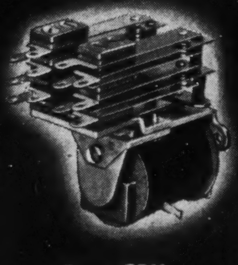
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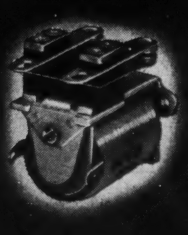
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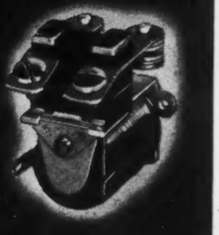
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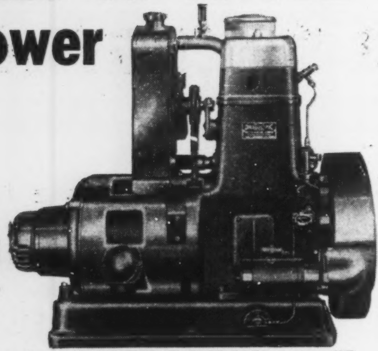
Standardize on WITTE Diesel Power *NOW* for Your Machine!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Power your machine for low operating cost with a WITTE Diesel unit. Producing no poisonous exhaust gases, they're *full* Diesels, starting and operating on cheap, non-explosive Diesel fuel oil. Occupy little space; require little care.

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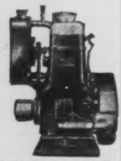
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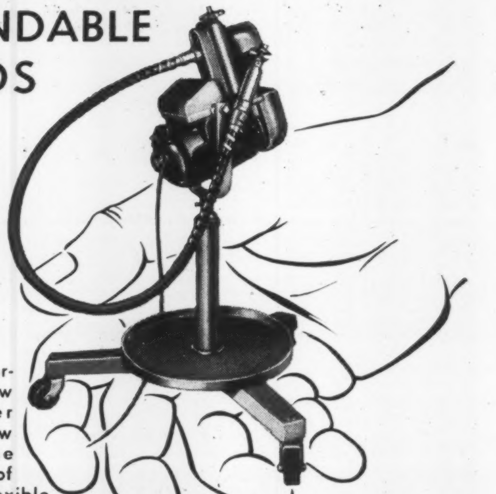

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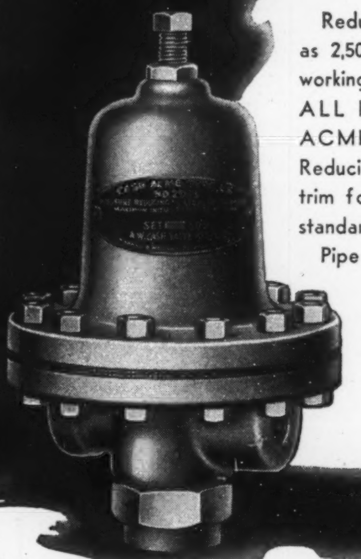

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Reduce pressure as high as 2,500 pounds down to working pressures with an ALL BRONZE CASH ACME Type LS Pressure Reducing Valve. Nitralloy trim for longer service is standard.

Pipe size ⅜", ½", ¾".

STOCK---CATALOGUE---SELL CASH·ACME Products,

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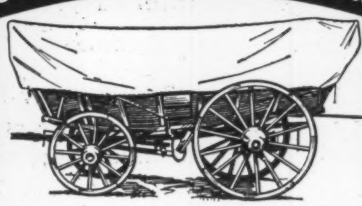

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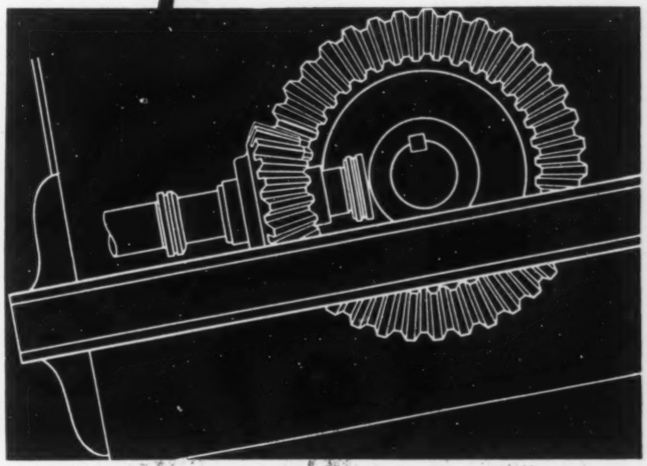

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"NEW IDEA" TO HIS NEPHEW

BUY BONDS HERE
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New Savings Bonds Plan won't affect the P.S.P.

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The Treasury Department acknowledges with appreciation the publication of this message by

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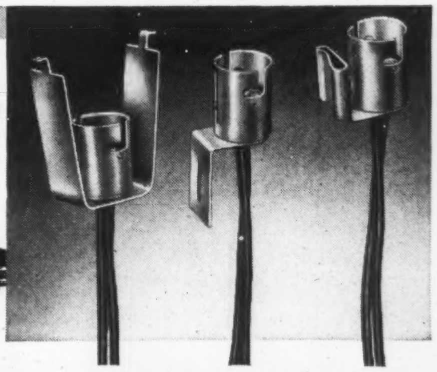
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CANDELABRA

NEW *UNDERWRITER'S APPROVED* BAYONET TYPE SOCKET ASSEMBLIES

Now you can get fine *Underwriter's Approved* candelabra Dial Light Socket Assemblies by DRAKE! The #900 series is designed for radio use, and the #A900 series for general use. Both are double contact, candelabra, bayonet Assemblies housing 115V household type lamps available from 5 to 25 watts. They are U.L. approved for 75W-125V service. Can also be used with 6V automotive lamps.

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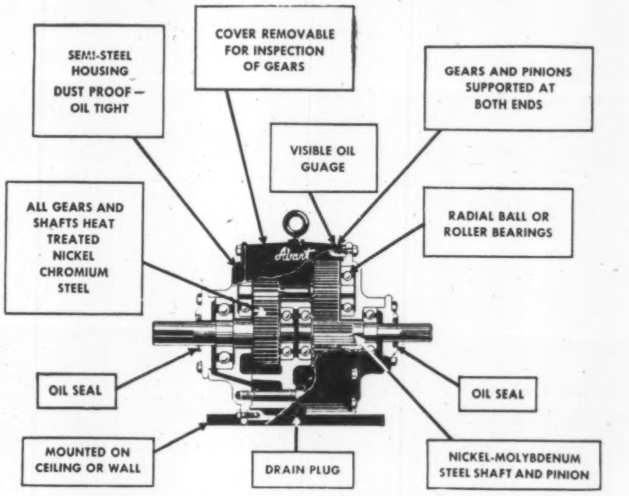
Socket and Jewel LIGHT ASSEMBLIES

DRAKE MANUFACTURING CO.
1713 W. HUBBARD ST. • CHICAGO 22

Inside view of an *Abart*

Straight Line Drive Spur Gear Reducer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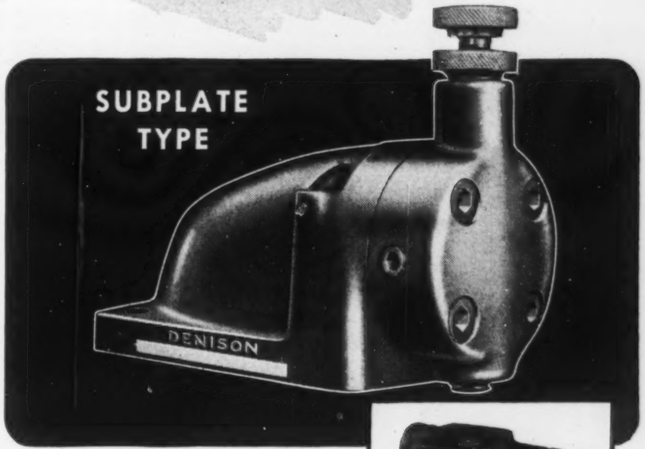
PRESSURE CONTROL TO *5000 PSI*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DENISON
¾" VALVES
RELIEF
SEQUENCE
UNLOADING

THREADED BODY TYPE

● Denison relief, sequence and unloading valves feature chatter-free operation at all working pressures to 5000 psi plus accuracy of pressure control—giving the top notch performance wanted in all hydraulic applications.

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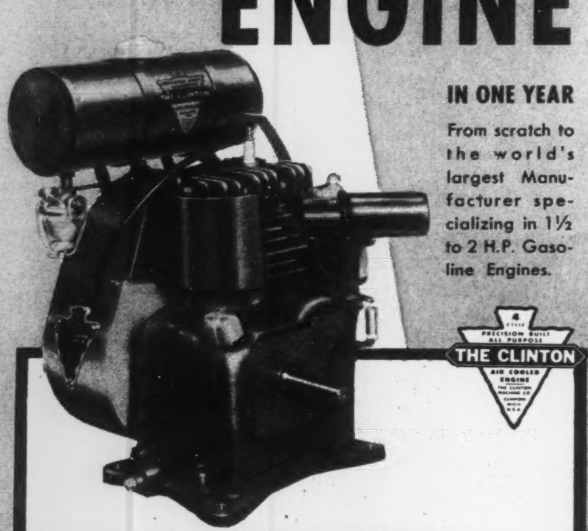

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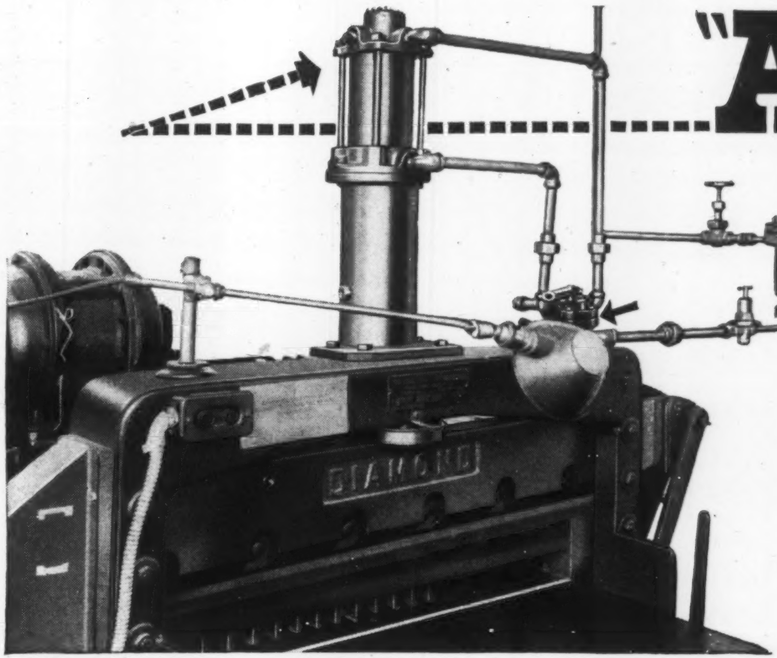

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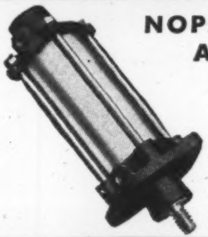

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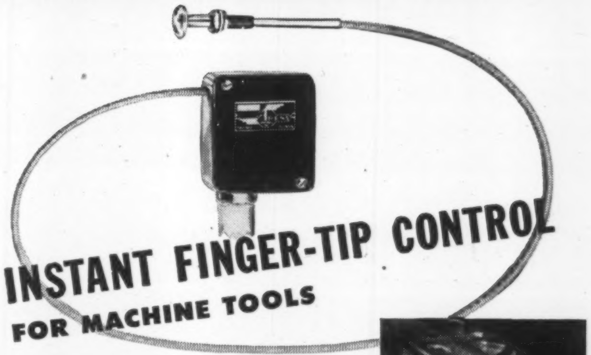

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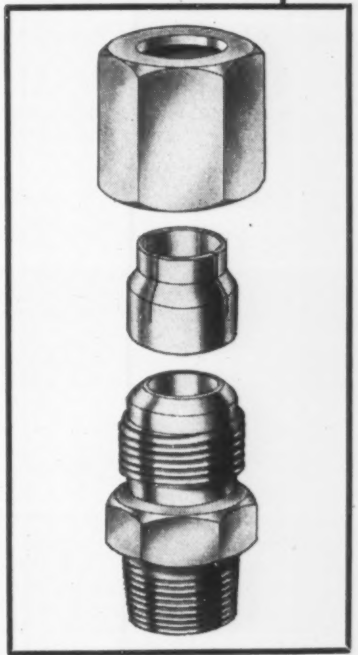

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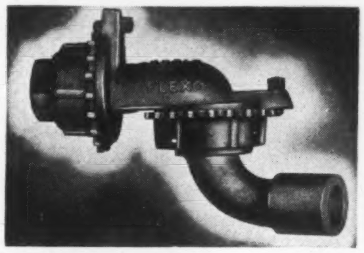

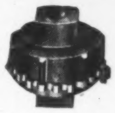

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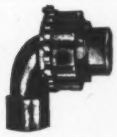

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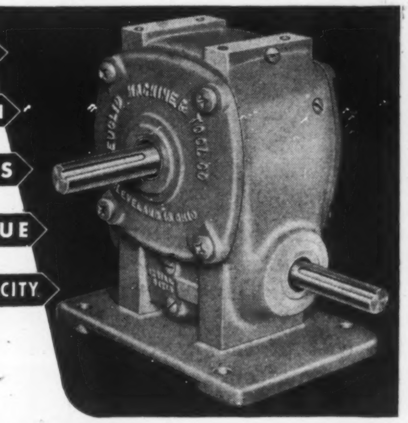

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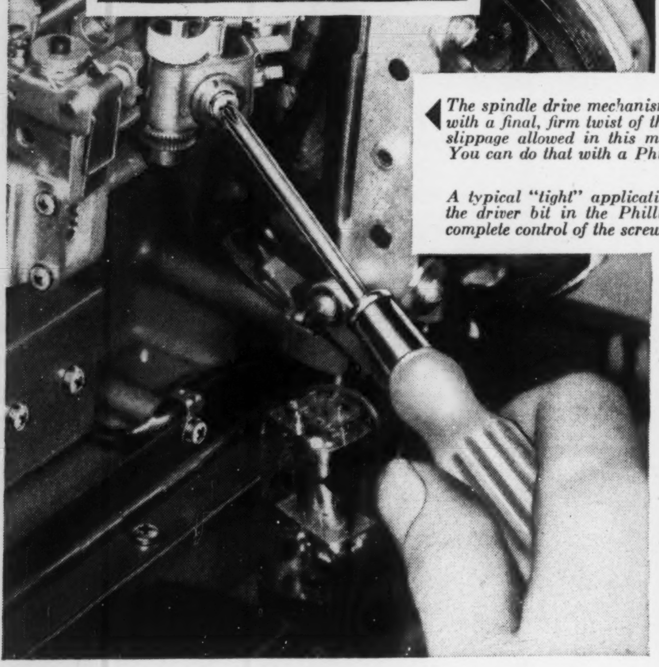

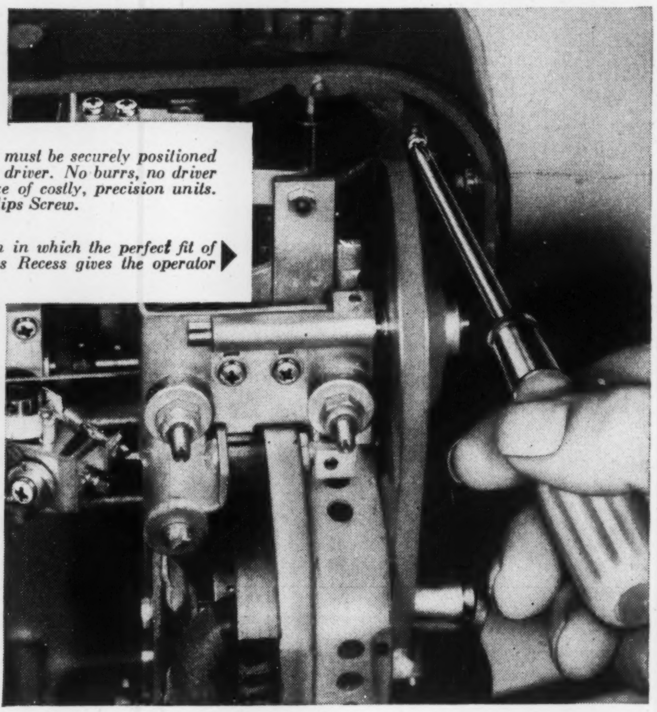

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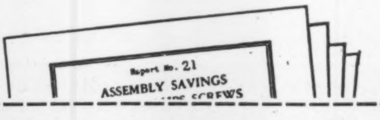

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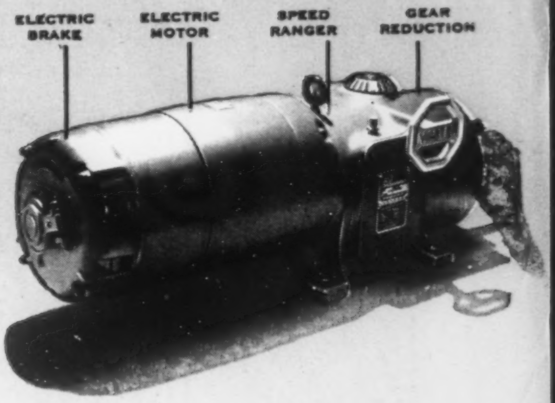
Address..........



On thousands of applications in every field of manufacture, stepless variable speed operation assures exactly the right speed for every operation . . . for every operator . . . the right speeds for each change in the consistency or shape of the material being processed. Such variable speed operation pays off in higher rates of production, a more uniform better quality product and more efficient performance of your equipment and your operators.

Master Speedrangers provide this infinitely variable speed in a compact, all-metal, mechanical variable speed unit whose durability and stamina has been proven with millions of hours of service all over the [illegible]

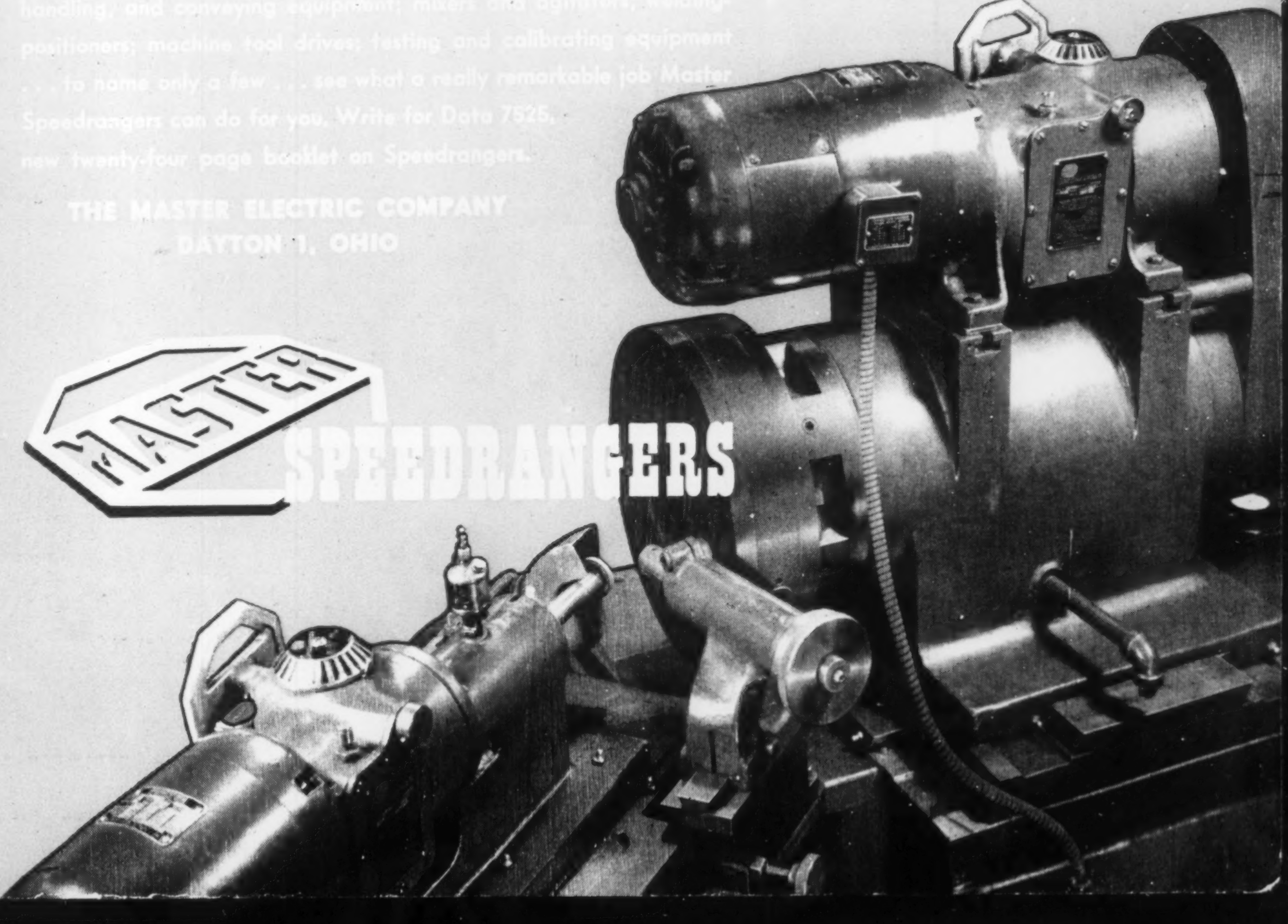
a unit that you can count right [illegible]

variable speed operation doesn't cost IT PAYS

Probably you will not need this same combination of features. However, the next time you need a drive for material processing, handling, and conveying equipment; mixers and agitators; welding-positioners; machine tool drives; testing and calibrating equipment . . . to name only a few . . . see what a really remarkable job Master Speedrangers can do for you. Write for Data 7525, new twenty-four page booklet on Speedrangers.

THE MASTER ELECTRIC COMPANY
DAYTON 1, OHIO

MASTER SPEEDRANGERS



How to keep a center drive on center

WHEN a center drive is mounted on Timken tapered roller bearings you know you've got precision — and can *keep* it.

Timken bearings hold spindles rigid—carry the weight of the work and keep it revolving accurately. Their tapered construction permits accurate preloading to any desired degree and carries radial and thrust loads without deflection or end-movement.

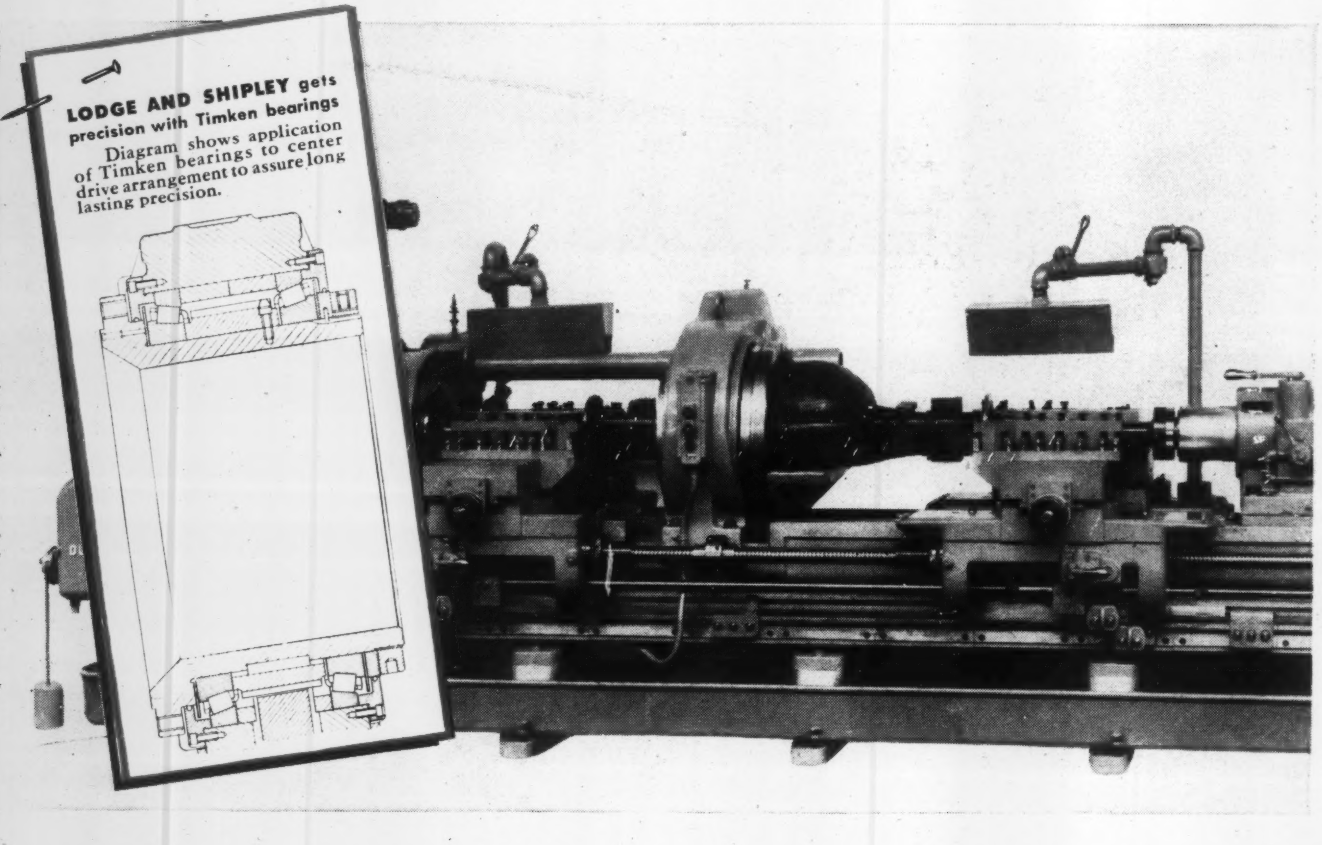
The rolls and races of Timken bearings are made of Timken fine alloy steel—hardened to give you a combination of load-carrying toughness and wear-resisting hardness. The line contact between rolls and races distributes the load over a wide area; greater loads can be carried with practically no wear.

Because Timken bearings are manufactured to extreme precision, and finished to almost incredible smoothness, friction is eliminated.

Remember, no other bearing can bring you *all* the advantages you get with Timken tapered roller bearings—backed by 49 years of bearing research and development. Be sure you have them in the machine tools you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio.

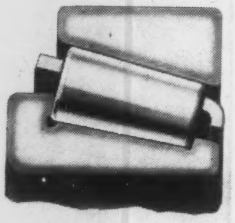
TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.



LODGE AND SHIPLEY gets precision with Timken bearings

Diagram shows application of Timken bearings to center drive arrangement to assure long lasting precision.



GREATER LOAD AREA

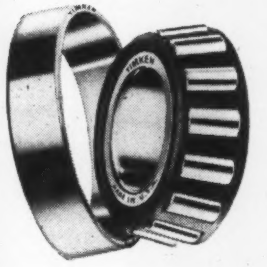
Because the load is carried on the *line* of contact between roller and race, Timken bearings carry greater loads, stand up under shock, hold shafts in line, wear longer.

The Timken Roller Bearing Company is the only bearing manufacturer in the country which makes its own steel, and leads in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ⊕ AND THRUST →⊕← LOADS OR ANY COMBINATION ✳